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A Technical Analysis:

The Performance of Composite Wood Joists Under Realistic Fire Conditions

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INTRODUCTION

The Challenge of Lightweight Construction

Many residential structures are now being built using lightweight construction materials such as composite wood joists or engineered wood truss systems, instead of traditional solid-sawn lumber. These lightweight construction materials have many advantages including lower costs, reduced use of natural resources and, in many cases, improved dimensional stability. Under non-fire conditions, the use of lightweight construction methods has consistently demonstrated equivalent or even superior performance relative to traditional sawn lumber.

Although lightweight construction materials and methods do have many positive attributes, there is some indication that they do not provide equivalent performance compared to traditional building techniques when subject to the loading imposed by structure fires. There have been several incidences of progressive structural collapse due to the failure of lightweight assemblies that have resulted in firefighter injuries and fatalities. These incidents have raised the awareness within the fire service of the need to differentiate between structures built using conventional materials and those built using lightweight materials when developing department operating procedures and fire ground tactics.

One example of the difference in fire performance of a lightweight structural member compared to solid sawn lumber is the behavior of composite wood joists. When a composite wood joist is exposed to fire, the thin oriented strand board used as the web in the joist is quickly consumed, which results in an inability of the joist to carry load and ultimately a failure of the supported floor assembly. While a solid sawn joist behaves in much the same way, there is significantly more mass that must be consumed before the member reaches the critical point where it is no longer able to carry load. Due to the greater mass per unit of surface area of the solid wood joist, it will support the floor assembly for much longer than its lightweight alternative when exposed to equivalent fire conditions. Figure 1 demonstrates a typical composite wood joist before and after fire exposure.

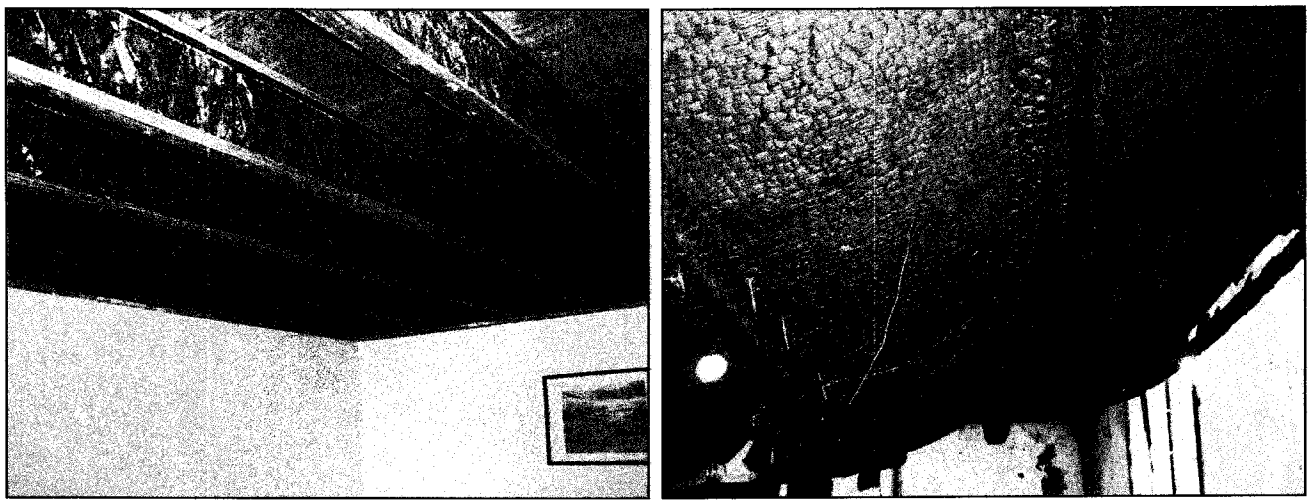

Figure 1: Composite wood joists before (left) and after fire exposure

Note how the composite wood joists exposed to a fire event have fallen apart due to the failure of the web, causing the ceiling to collapse. There is growing evidence that the materials employed in lightweight construction are more apt to weaken and fail much faster than conventional construction materials, resulting in sudden catastrophic collapse of ceiling and floor assemblies and an increased risk of injury or death to building occupants and firefighters.

In addition to the reduction in time to failure of lightweight structures, there are also some indications that structures built using these techniques provide less warning of impending collapse than conventional construction materials. Typical indications of failure used in structures built using sawn lumber, including sagging floors, loud noises and a change in the "tone" when sounding the floor with tools, may not apply to lightweight structures.

To better understand the behavior of composite wood joists in real fire situations and to evaluate the impact of residential sprinklers on the integrity of structures employing composite wood joists, a series of fire tests was conducted at Underwriters Laboratories (UL). This white paper presents the results from this test series.

Residential Sprinklers

Residential fire sprinkler systems are specifically intended to provide a minimum of 10 minutes of egress time to dwelling occupants and therefore are primarily life safety devices. Residential sprinklers are not intended to protect the structure, however in most real world cases a single sprinkler operates and controls or extinguishes the fire, saving both lives and property. Given the focus on the life safety aspect of residential sprinkler systems, there has been limited research or testing designed to quantify the property protection benefits of these systems. Additionally, the research that has been conducted to quantify the value of residential sprinklers has typically addressed only the building occupants and has not considered additional benefits arising from fire fighter safety. It is generally observed that once a fire progresses from its area and material of origin and begins to involve the building structure, it is difficult for offensive manual firefighting operations to successfully intervene. A very common outcome in these cases is total loss of the involved structure.

Real-scale tests using sprinklered and unsprinklered structures including typical lightweight, composite wood joist ceiling/floor assemblies were conducted at UL. The tests demonstrated that residential sprinklers operating at flow rates as low as 13 gpm can arrest fire growth rates sufficiently to prevent excessive fire damage and structural collapse. Tests without sprinklers indicate total failure of the structure can occur in under 10 minutes from ignition.

UL Testing

Setup

Many of the firefighting deaths associated with lightweight construction occur as a result of a fire initiating in the basement area of a home. This scenario is particularly hazardous because firefighters frequently enter on the main level of the house, unaware of the exact location of the fire. Additionally, this is the one area of the structure where it is common to find likely sources of ignition including workshops, impromptu living areas and fuel fired equipment such as boilers and hot water heaters. Finally, in most cases the framing material is exposed, allowing fires to rapidly involve the structural members supporting flooring on the main level of the house. To simulate this scenario, the test setup represented a seating area that has been located in a basement. This scenario was selected since the large volume of synthetic material (i.e. furniture, carpet, etc.) is particularly challenging to the sprinkler system. However, any scenario that would lead to involvement of the structure and ultimately flashover of the compartment most likely would have generated equivalent results to this fuel package. The fuel package arrangement utilized is demonstrated in figure 2.

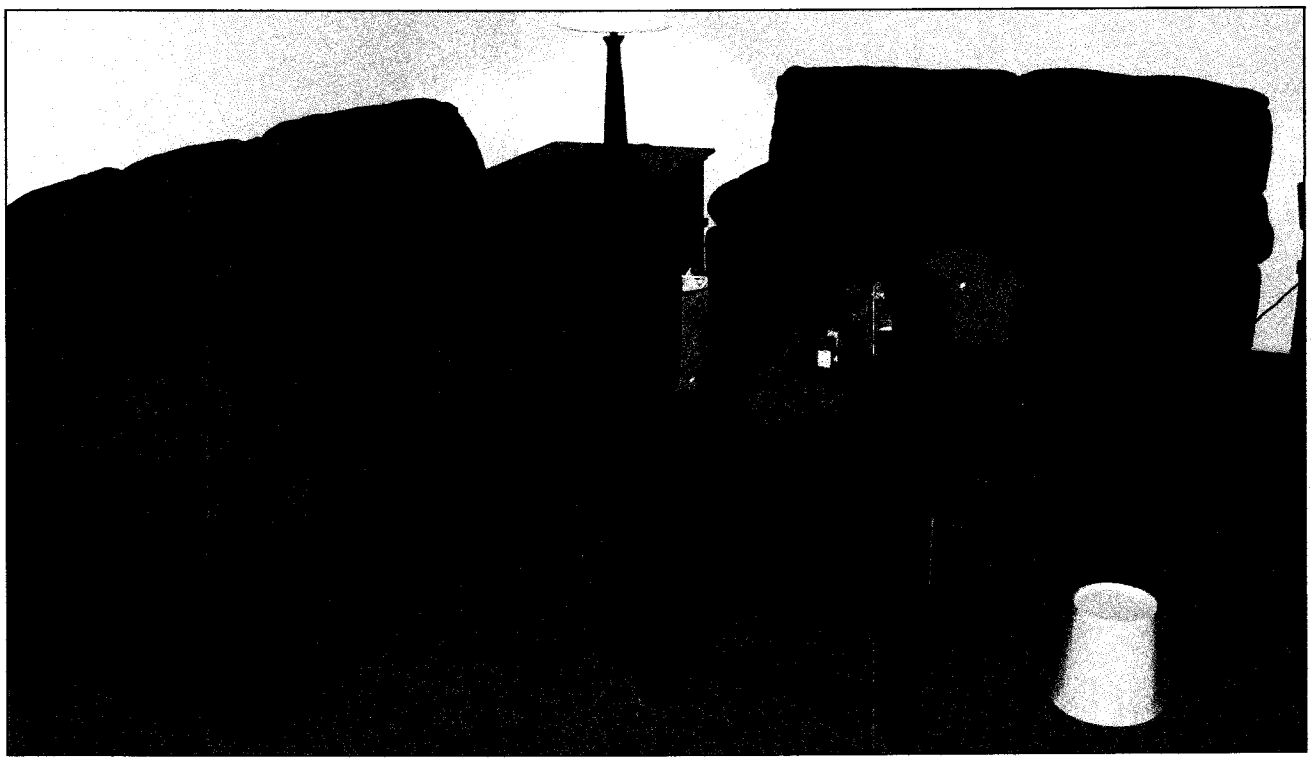

Figure 2: Fuel package used for all tests. White bucket on floor was used to protect floor radiometer during setup; the bucket was removed prior to each test.

The seating area measured 16 ft. x 16 ft. in plan area with a ceiling height of 8 ft. to 9 ft. 2 in depending upon the floor assembly tested. A single doorway measuring 34 in. in width and 80 in. in height was centered on the wall opposite the ignition corner. The walls were constructed of trade size 2 in. x 4 in. studs covered with two layers of a nominal ½ in. sheet rock painted with a standard commercial latex paint. Figures 3 and 4 show the dimensions of the test compartment and the placement of items in the room. The total fuel package, excluding the combustible components of the structure, included a couch and loveseat, a coffee table with plastic children's toys, two end tables with lamps, a picture on the wall and an empty entertainment center. The floor was covered in a standard Berber type carpet. The ignition scenario included a small wastebasket filled with a ½ lb of shredded 20 lb copy paper and a polyester blanket draped over the arm of the couch.

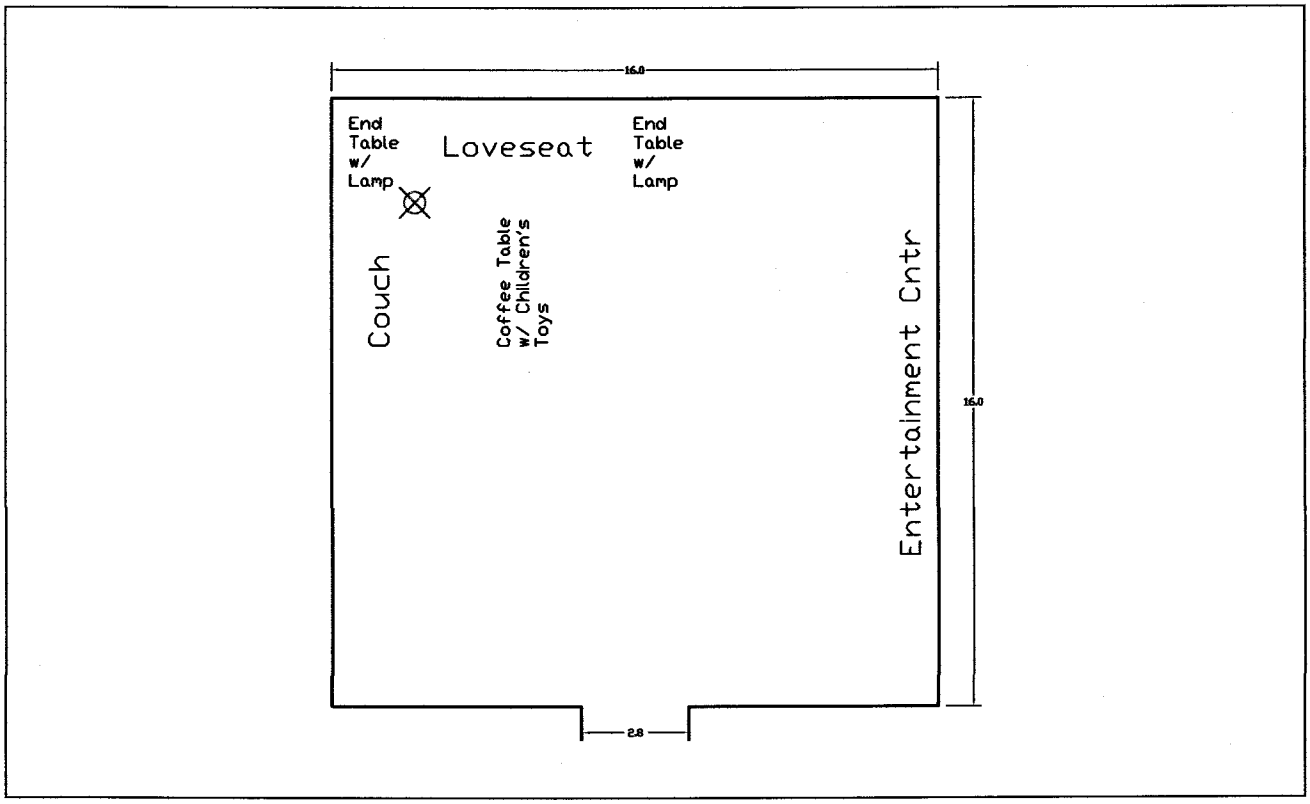

Figure 3: Test setup in plan view. The red symbol represents the ignition location.

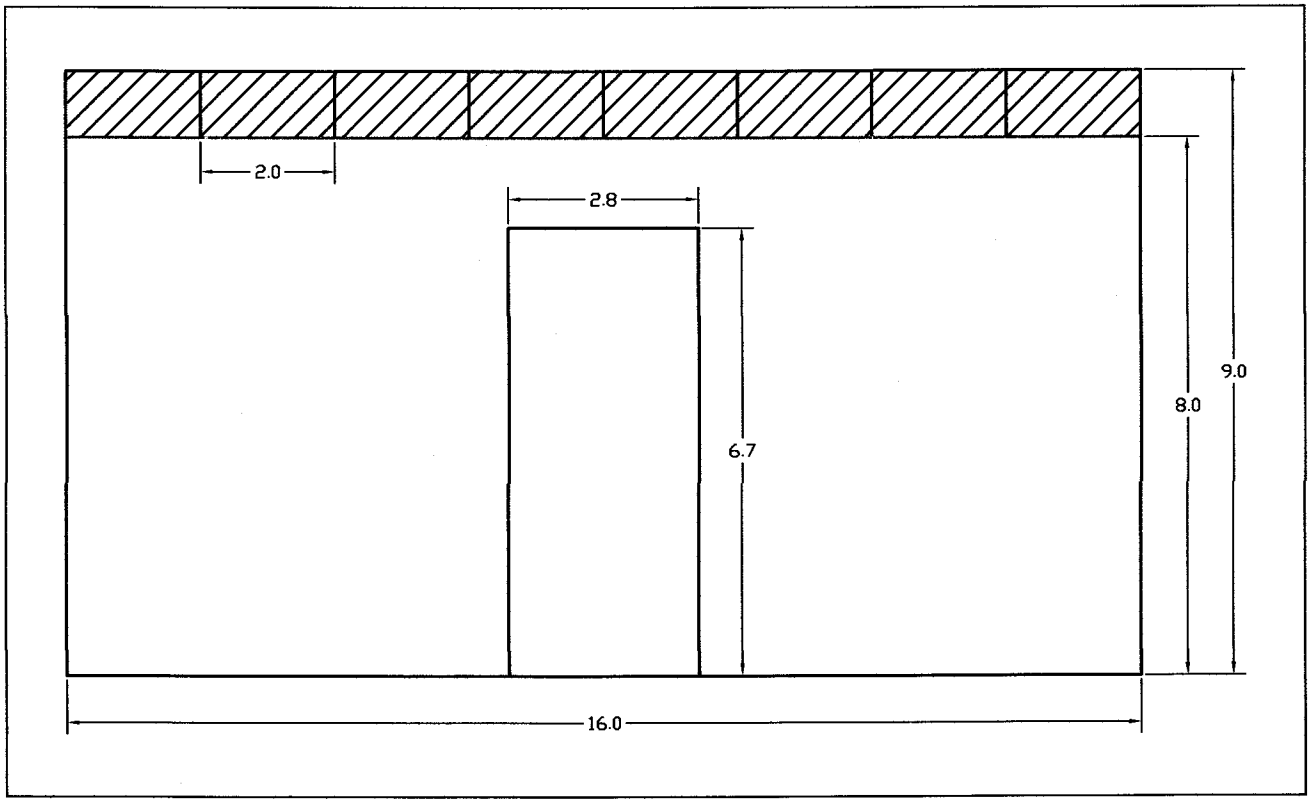

Figure 4: Test setup in elevation view. The horizontal red line represents the sheetrock on the ceiling (in exposed tests) or the bottom of the joists (in unexposed tests).

The ceiling was constructed of composite wood I-joists measuring 11-7/8 in. deep with 3 in. wide chords. The joists were spaced two feet on center (i.e. the typical maximum spacing for residential occupancies) and the bottom of the beams was eight feet above the floor. In one of the tests (Test 1), the bottom of the joists was also covered with two layers of ½ in. sheetrock; all remaining tests were conducted with the joists exposed as shown in figure 5.

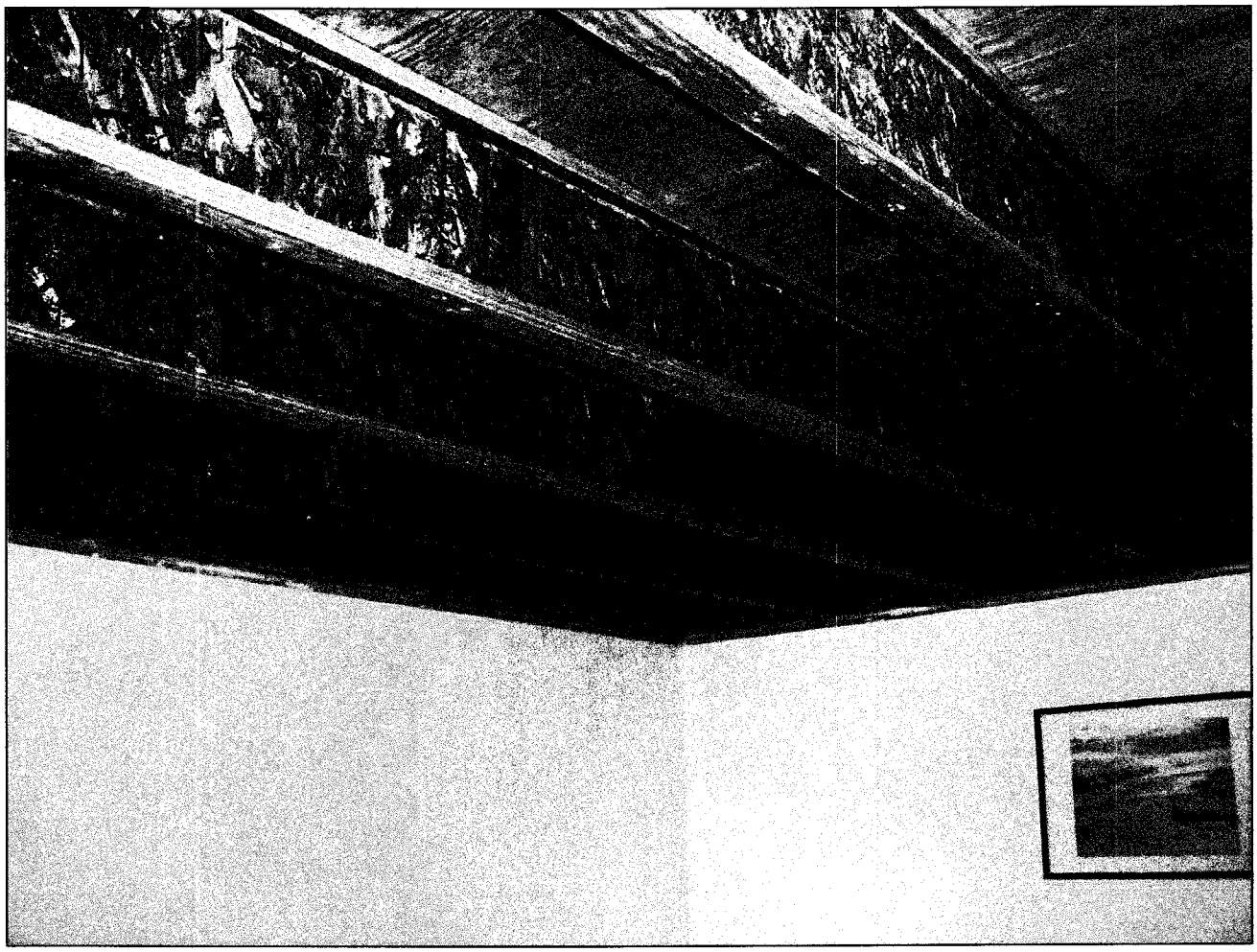

Figure 5: Exposed composite wood joists representing main level floor assembly

To represent the main floor above the simulated basement, the composite wood joists were sheathed in 7/8 in. plywood subflooring. To accurately capture the heat transfer through the assembly, the floor was finished with a typical residential carpet pad and Berber carpeting. Concrete blocks where used in an effort to simulate a typical live load representing the furnishings above the test enclosure. These blocks were weighed and located to represent the same arrangement as the furniture package in the basement area below. Additionally, two fire fighter mannequins were positioned on top of the ceiling/floor assembly as shown in figure 6. The firefighter mannequins were outfitted with typical items including turnout gear, a helmet and a self contained breathing apparatus (SCBA). The standing mannequin, standing on a joist, weighed 300 pounds while the crawling mannequin, straddling a joist, weighed 380 pounds. The remainder of the cinder blocks totaled 600 pounds resulting in a total live load of 1280 lbs or about 5 lbs/ft^2. The firefighters were attached to the ceiling with cables to permit them to be pulled from the burning compartment after the collapse of the ceiling/floor assembly.

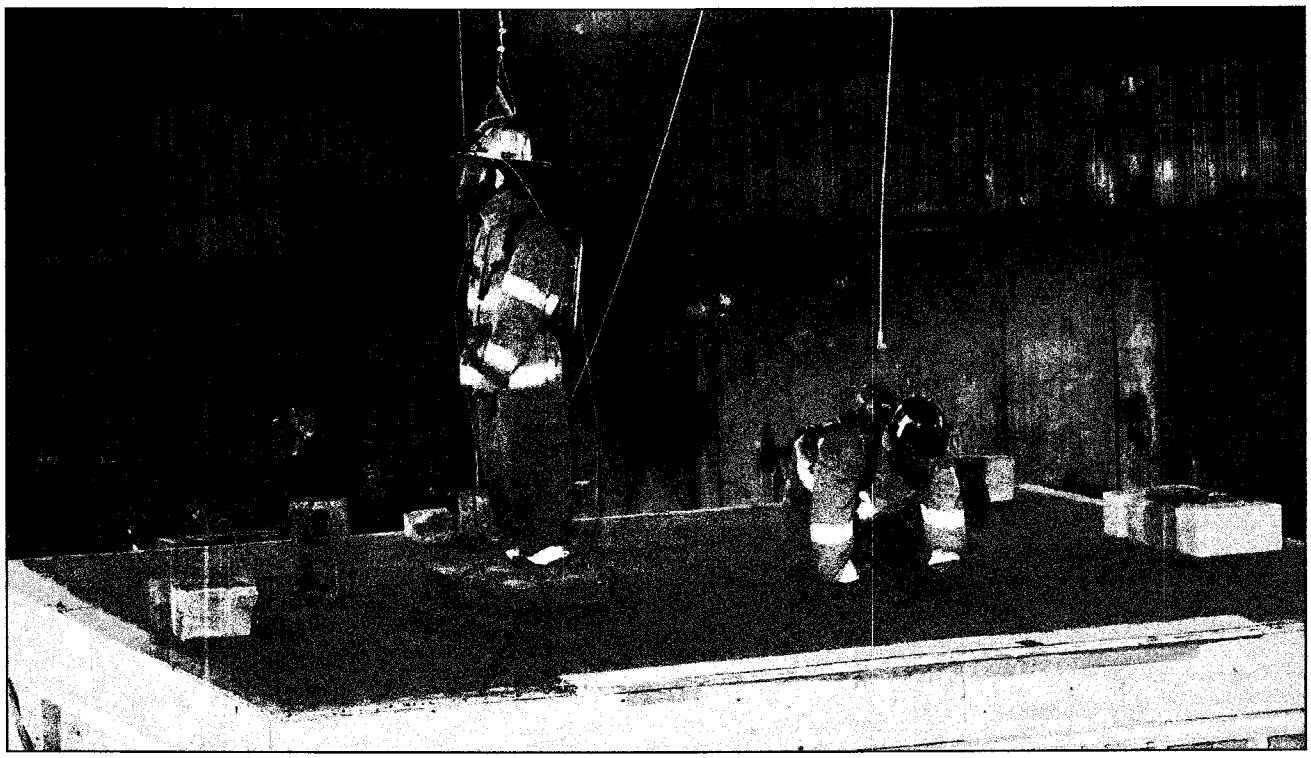

Figure 6: Loading on top of enclosure

The fire was started using three matches wrapped in nichrome wire (electric match) located near the base of the wastepaper basket and in direct contact with the shredded 20 lb printer paper. The blanket located over the arm of the sofa was draped into the waste basket to aid in the reproducibility of flame spread to the arm of the couch. The estimated peak heat release rate of the upholstered sofa, which is only part of the fuel package, was measured as part of a previous program at approximately 12MW.

Instrumentation

A radiometer was positioned at floor level with a field of view towards the ceiling to measure the heat output of the fire (located underneath the white bucket in figure 2 for protection during setup; the bucket was removed before the test). Along with the radiometer, there was a thermocouple located at the ceiling directly above the fire as well as a tree of seven thermocouples spaced at 1 ft. intervals in the doorway. In the sprinklered tests, a thermocouple was also placed next to each sprinkler. High quality professional video and thermal imaging video were obtained for all of the tests.

In Test 5, additional instrumentation was added in an effort to better understand the method of collapse as well as to verify temperature readings from the thermal imaging camera from previous tests. Twenty thermocouples were added at five different locations for a total of 88 additional thermocouples with respect to the previous tests (the location farthest from the fire had only eight thermocouples due to restrictions from the data acquisition system). Thermocouples were located in the ceiling/floor assembly starting at the carpet on top of the structure all the way down to the plywood sheathing. Temperature measurements were also taken on each side of the joist and embedded into the joist at each location. The location of each thermocouple group and the arrangement of the thermocouples at each location is shown in figures 7 and 8, respectively.

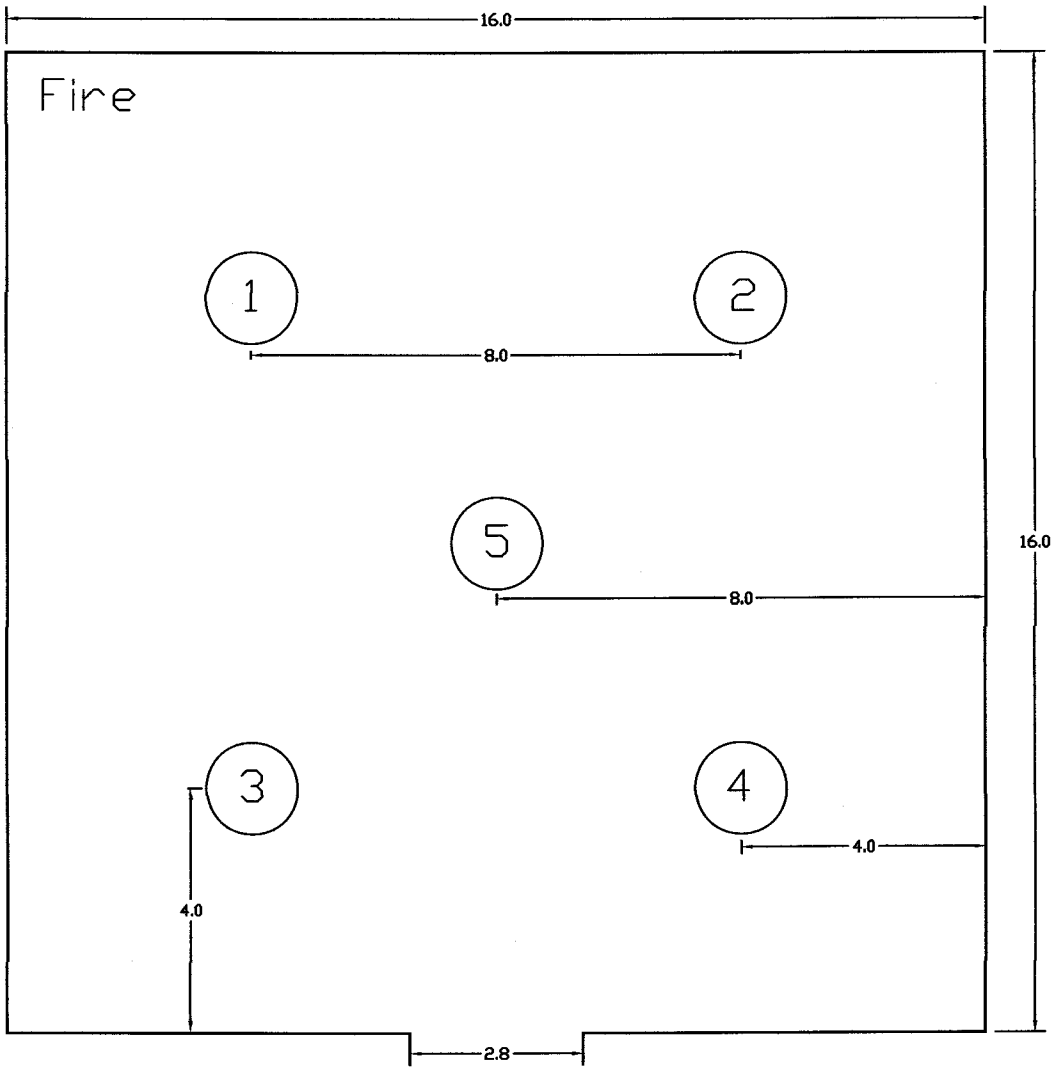

Figure 7: Additional thermocouple locations. Each location contained 20 thermocouples except for location 4, which had only 8 thermocouples.

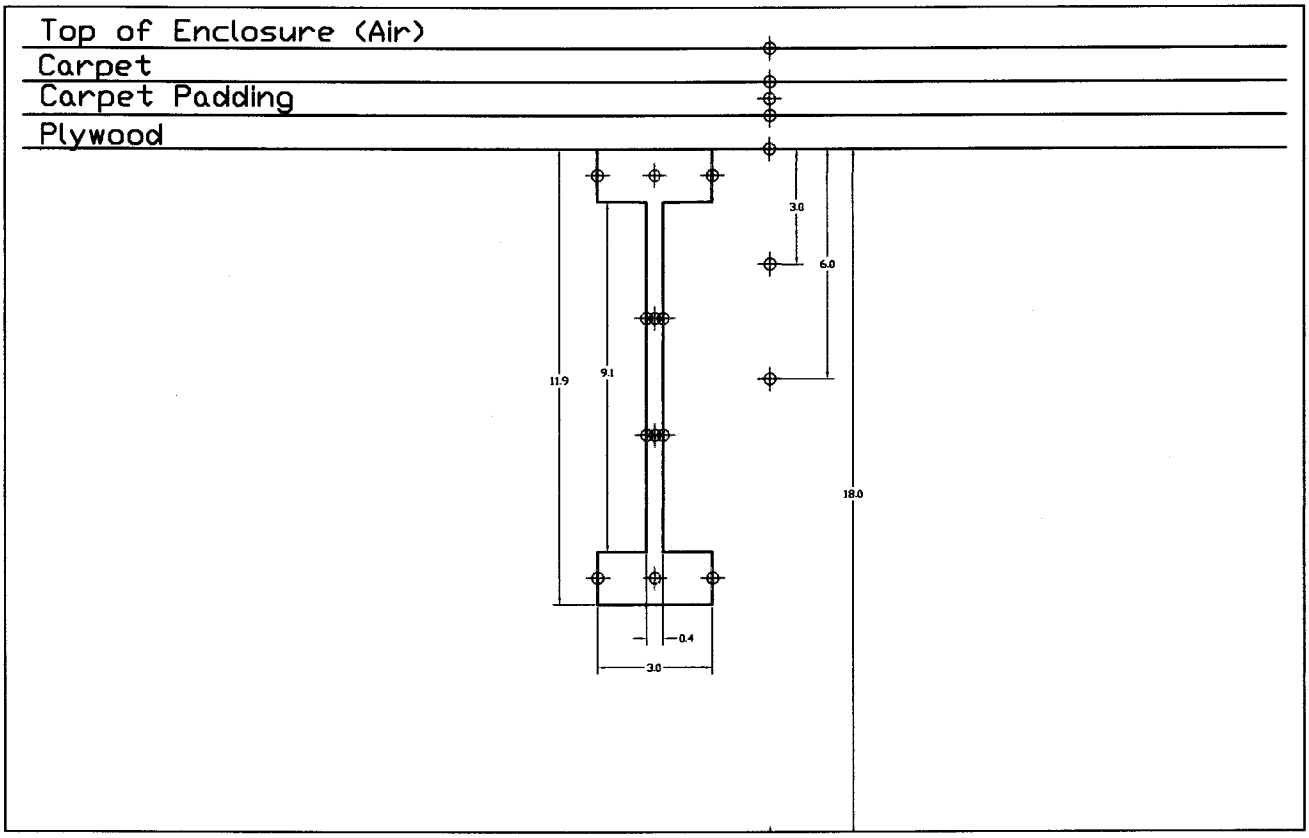

Figure 8: The thermocouple arrangement at each location. The green symbols represent thermocouples that were present at all 5 locations; the blue symbols represent the thermocouples that were at each location except location 4.

In addition to the thermocouples, a Scott Health and Safety thermal imaging camera, a commercially available unit typically used by firefighters, was placed in the standing mannequin's hand. The thermal imaging camera recorded the temperature of the carpet as well as a visual image on top of the structure near the mannequin in the approximate center of the ceiling/floor assembly. The image is similar to that which would be seen by a firefighter entering the main level of the home with a basement that will reach flashover conditions.

Sprinklered Tests

Three sprinkler scenarios were evaluated as part of this program; including a single sidewall sprinkler, four pendent sprinklers and a single pendent sprinkler. Each scenario is demonstrated in figure 9 and the tests are described as follows.

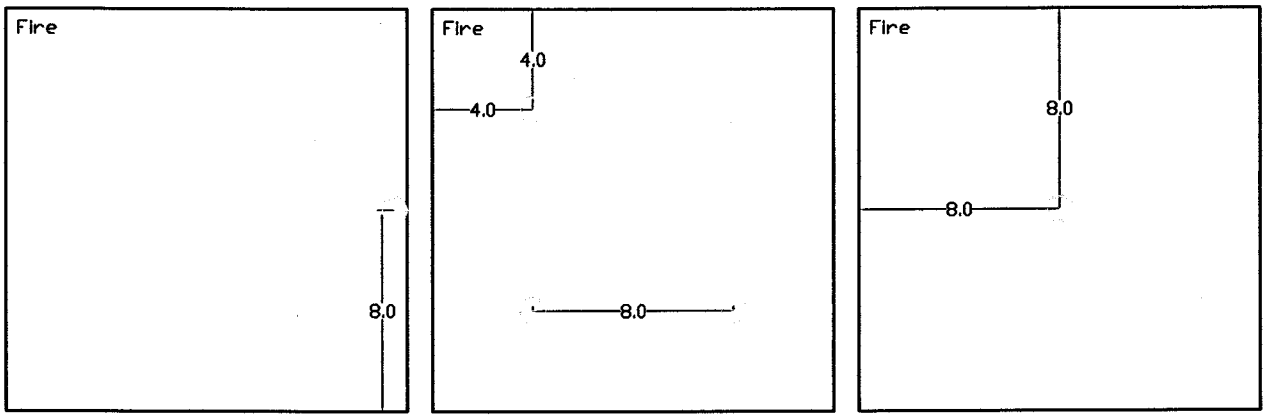

Figure 9: Sprinkler layouts for Test 1, Test 2 and Test 3 (from left to right)

Test 1: 4.2K Residential Horizontal Sidewall

The first test (Test 1) used a 155°F rated, Tyco Model LFII 4.2K Residential Horizontal Sidewall Sprinkler (SIN TY1334) flowing at 20 gpm (22.7 psi) and located 5 in. below the ceiling centered on the wall with the entertainment center. The sprinkler was installed according to manufacturer guidelines as described in Tyco Technical Datasheet TDS TFP410, as found in Appendix B. For the sidewall sprinkler test, the composite wood joists on the ceiling were covered with two layers of ½ in. sheetrock.

In this test, the sprinkler operated 2:55 (min:sec) after ignition and control of the fire was achieved less than 2 minutes later. The damage, shown in figure 10, was limited to the items intimate with ignition.

The first test was considered successful due to the limited damage to the fuel package and the comparatively low temperatures that were maintained for the duration of the test. At no point during the test did the fire progress from the furniture into the structural portion of the test assembly.

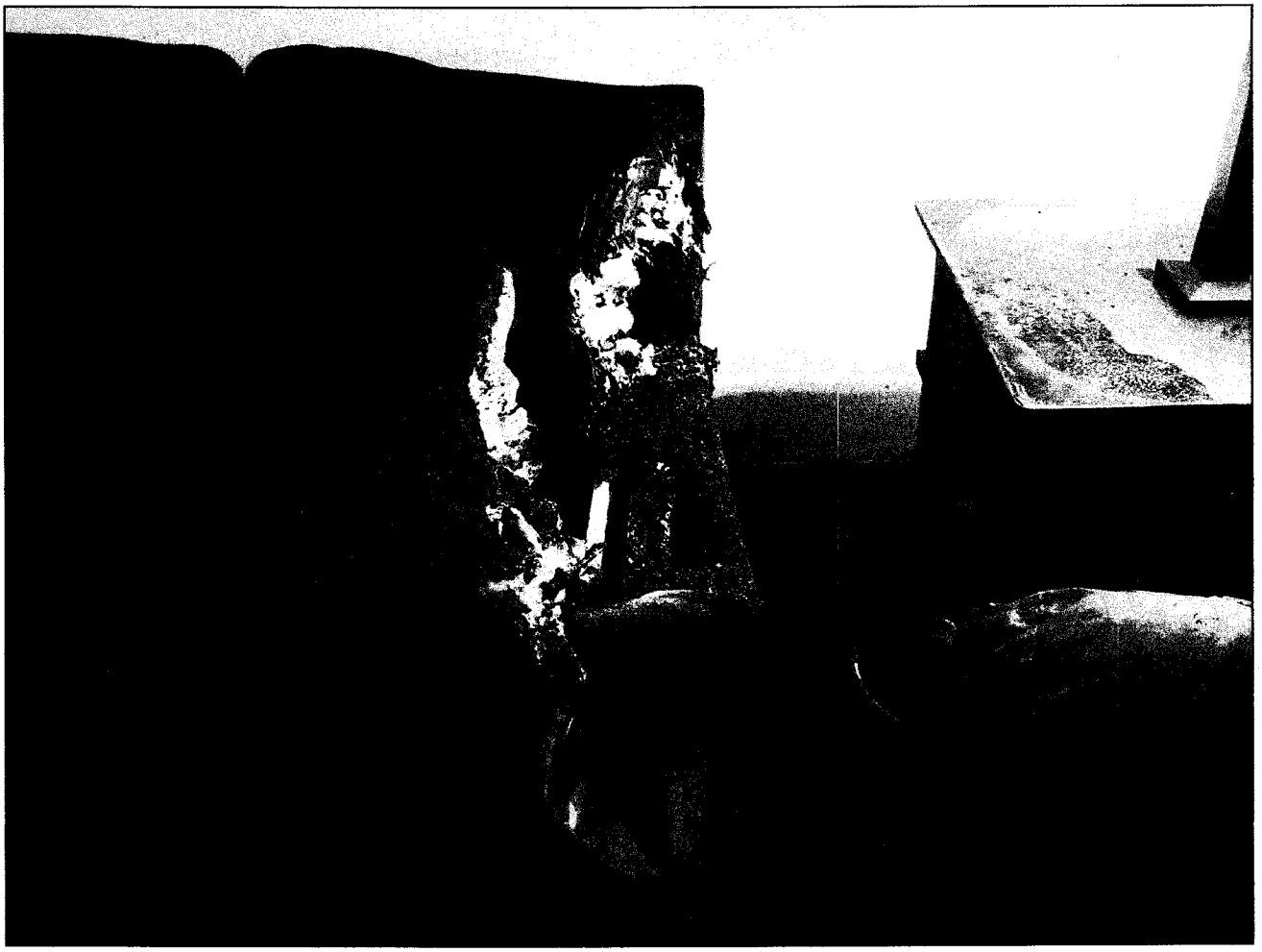

Figure 10: Test 1 Damage Assessment

Test 2: 4.9K Residential Pendent Sprinklers with 64 ft^2 Coverage Area

The second sprinklered test (Test 2) consisted of four 155°F rated, Tyco Model LFII 4.9K Residential Pendent Sprinklers (SIN TY2234) flowing at 13 gpm (7 psi) per sprinkler and arranged at their minimum spacing of 8 ft. x 8 ft. (64 ft^2 coverage area). The sprinklers were arranged with each sprinkler located four feet from each adjacent wall of the room as shown in the middle diagram in figure 9. The installation, using exposed CPVC piping, placed the sprinkler with 1.5 in. vertical distance between the bottom of the I-joist and the deflector and a horizontal distance of 2 in. between the joist and the centerline of the sprinkler. Therefore, the sprinkler was installed according to manufacturer guidelines as described in Tyco Technical Datasheet TDS TFP400, as found in Appendix B. The composite wood joists were exposed in this test with CPVC sprinkler piping installed fully exposed below the joists.

Although there were four sprinklers in the room, a single sprinkler operated 1:13 from ignition and successfully controlled the fire within 3 minutes. The damage from the second test is demonstrated in figure 11.

The second test was considered a success due to the quick activation of the sprinkler limiting the damage to a small area of the room.

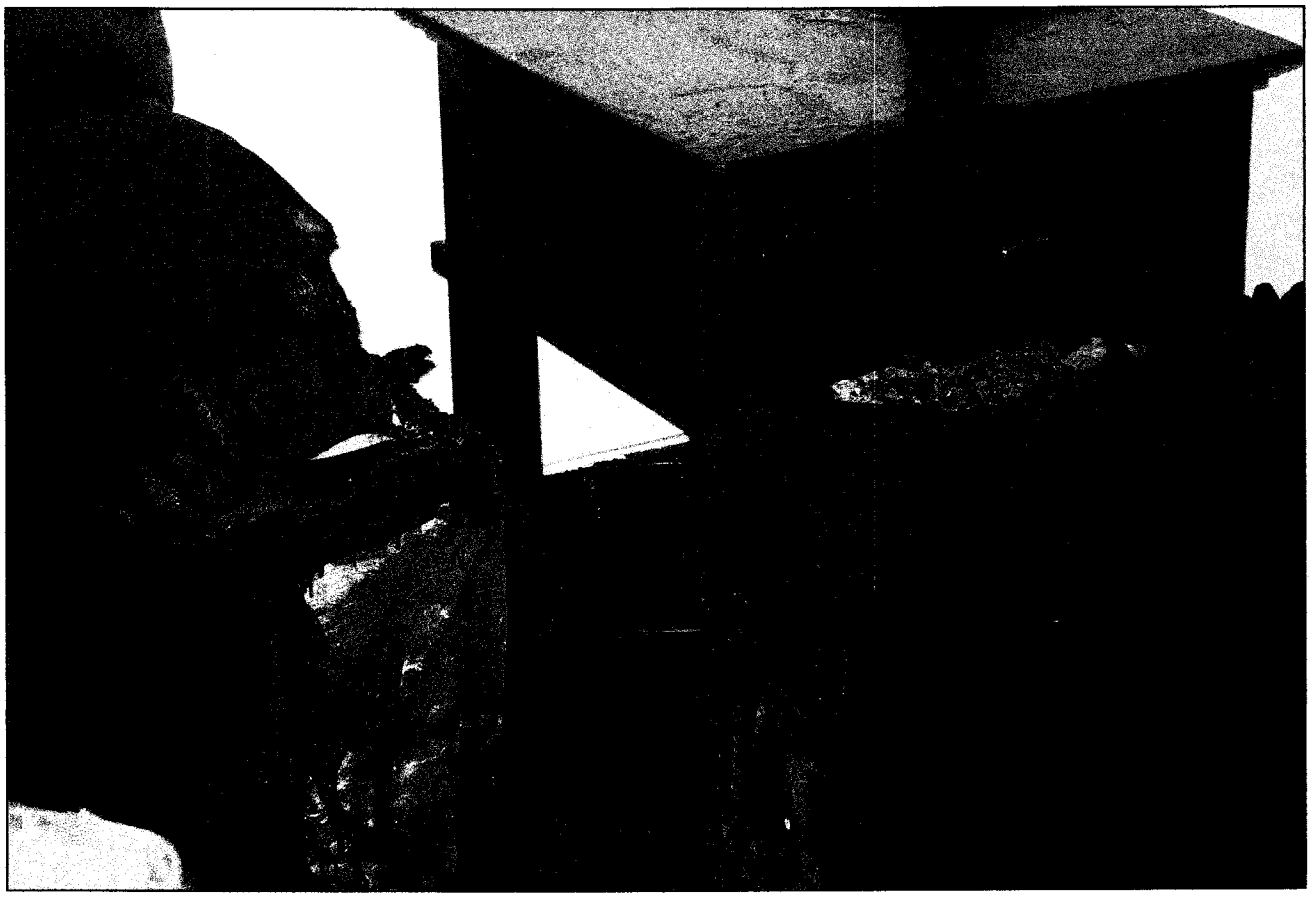

Figure 11: Test 2 Damage Assessment

Test 3: 4.9K Residential Pendent Sprinkler with 256 ft² Coverage Area

The third sprinklered test (Test 3) consisted of one 155°F rated, Tyco Model LFII 4.9K Residential Pendent Sprinkler (SIN TY2234) flowing at 22.5 gpm (21 psi). The single sprinkler, located in the center of the room, protected the entire 16 ft. x 16 ft. space (256 ft² coverage area). The installation, using CPVC piping, placed the sprinkler with 1.5 in. vertical distance between the bottom of the I-joist and the deflector and a horizontal distance of 2 in. between the joist and the centerline of the sprinkler. The sprinkler was installed according to manufacturer guidelines as described in Tyco Technical Datasheet TDS TFP400, as found in Appendix B. The composite wood joists were exposed in this test with CPVC sprinkler piping installed fully exposed below the joists.

The center sprinkler operated 3:19 from ignition and achieved control less than one minute later. The post-test damage is shown in figure 12.

This test was considered successful due to the relatively minor damage to the fuel package. At no point did the fire progress from the furniture to involve the structural elements of the test enclosure.

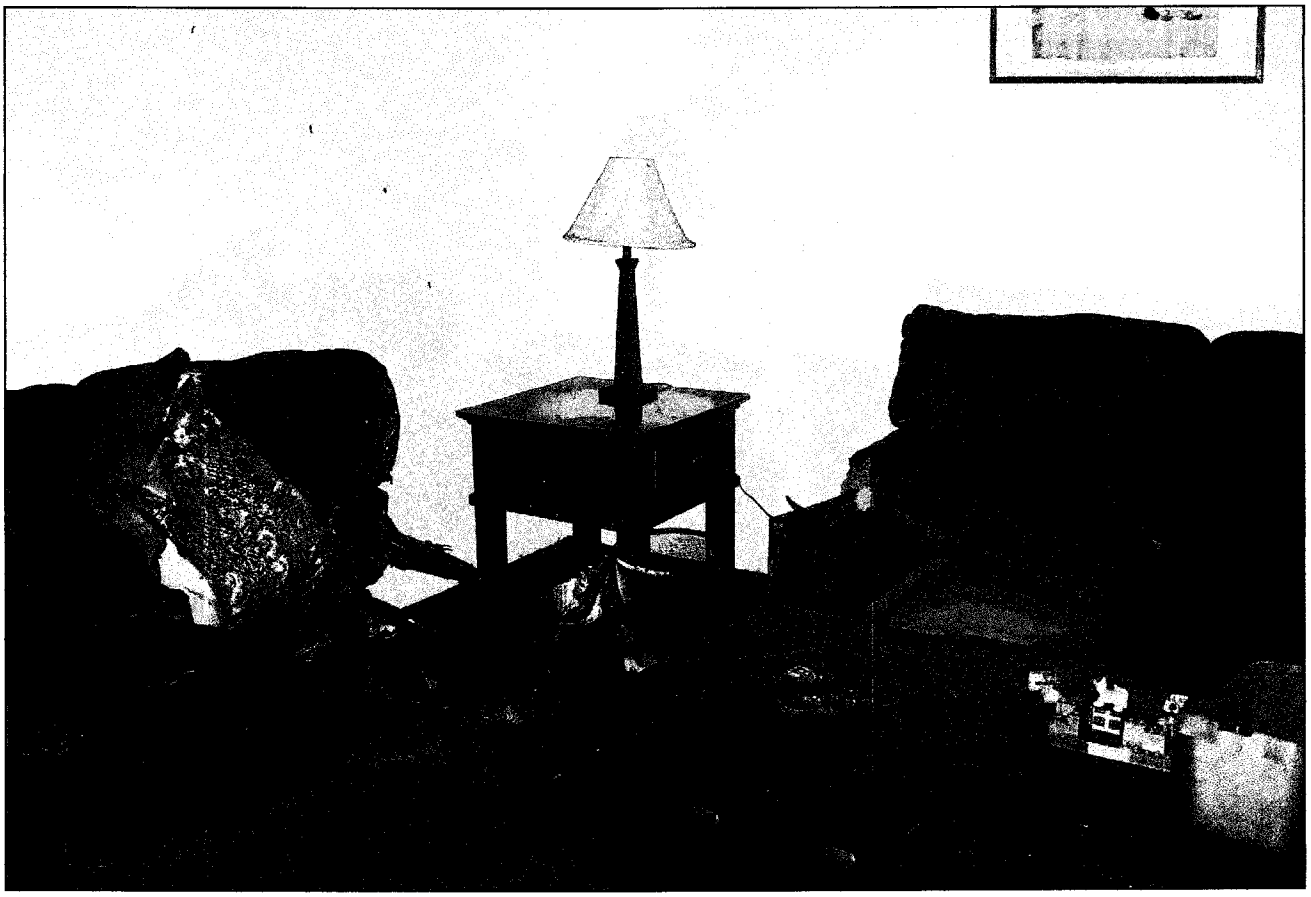

Figure 12: Test 3 Damage Assessment

Unsprinklered Tests

In order to evaluate the performance of the lightweight structural members when subject to uncontrolled fires, two tests were conducted without sprinkler protection. As noted in the sections above, one sprinkler successfully controlled the fire in every sprinklered test and the fire did not involve the structural elements of the test compartment. Fire damage was limited to the couch, loveseat and end table adjacent to the ignition location in all of the sprinklered tests.

Two unsprinklered tests (i.e. "freeburn") were performed using the same fire scenario and structural loading as the sprinklered tests with exposed composite wood joists. Each of these two tests was run until approximately one minute after roof collapse. The first freeburn test (Test 4) had the same instrumentation as the sprinklered tests while the second freeburn test (Test 5) had additional instrumentation.

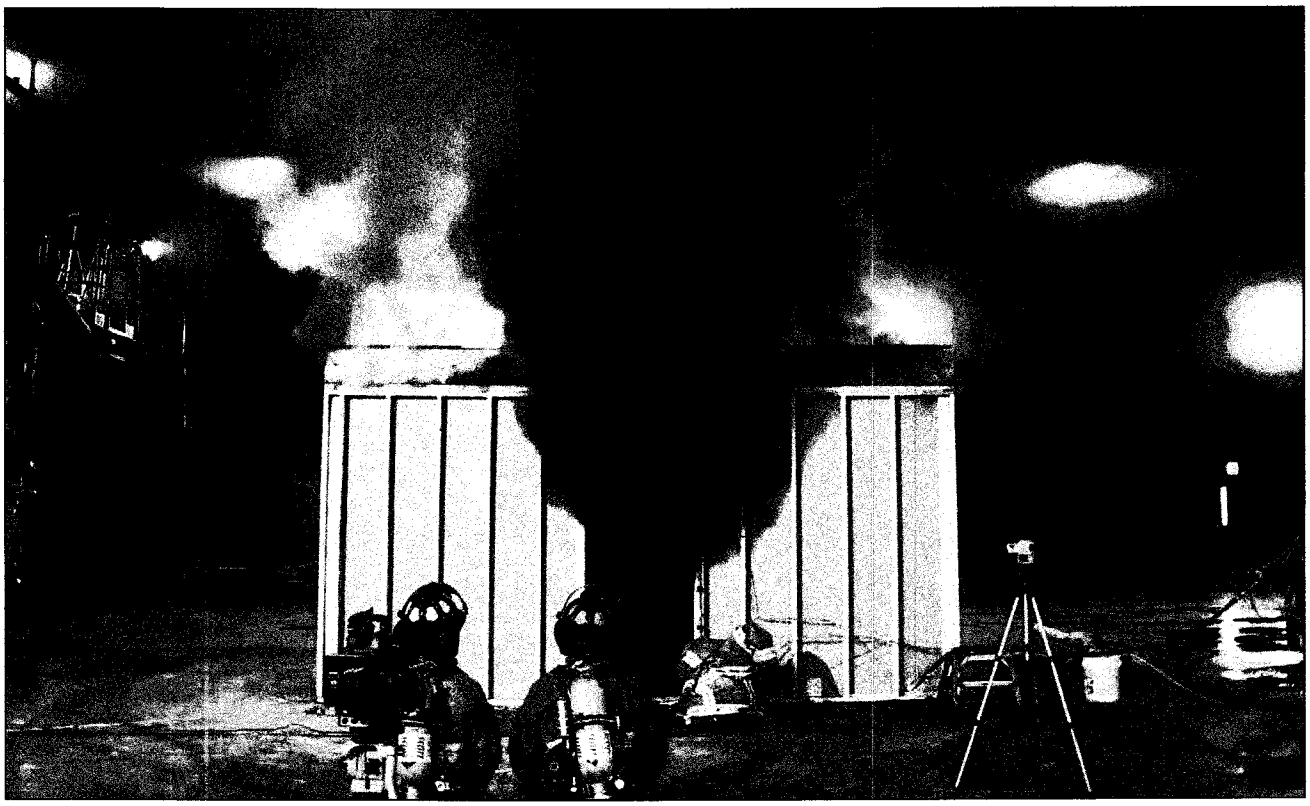

Figure 13: Test 4, first unsprinklered test, just before flashover

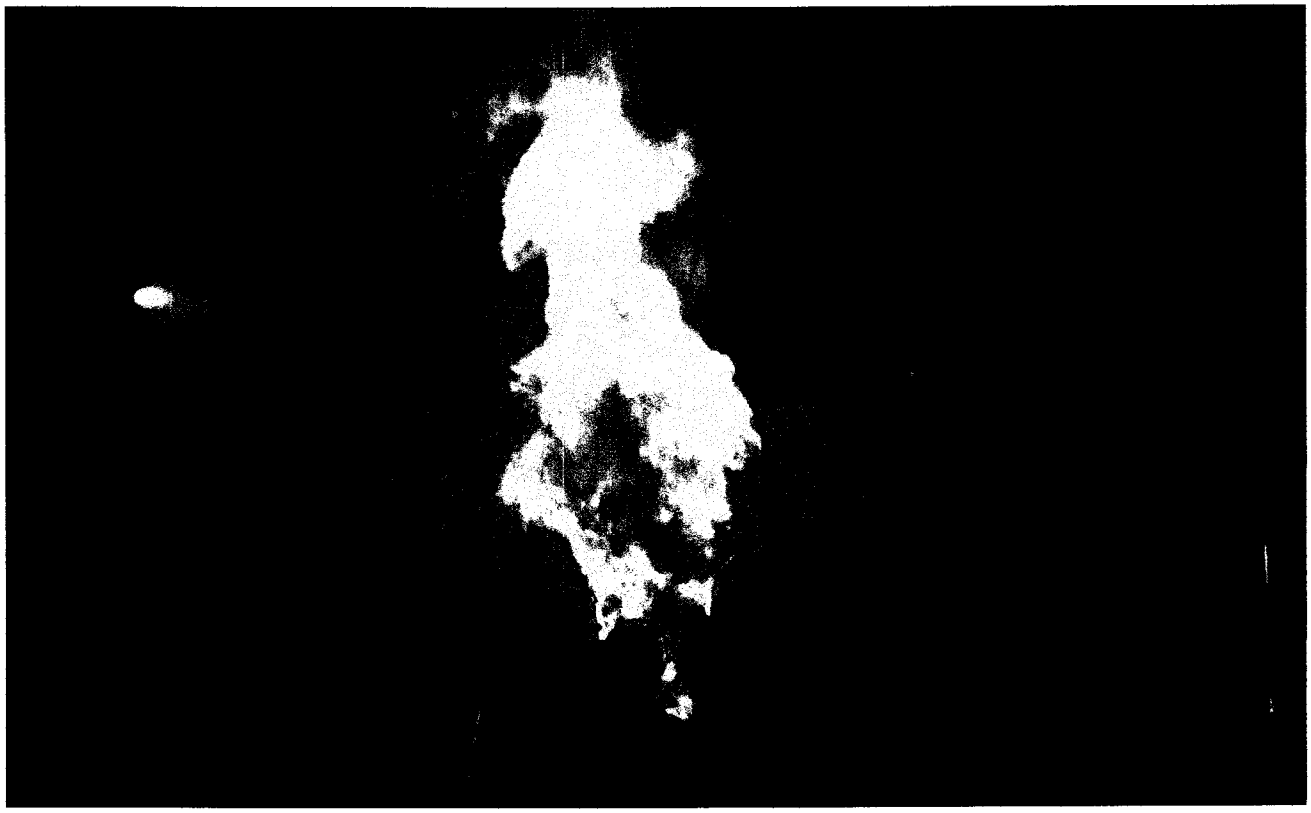

Figure 14: Test 4, first unsprinklered test, just after flashover

Test 4: First Unsprinklered "Freeburn" Test

The first unsprinklered test (Test 4) resulted in flashover 7:09 from ignition resulting in flame extension well outside the doorway opening. Photographs of just before and just after flashover are shown in figures 13 and 14.

The floor assembly collapsed with minimal warning 11:30 from ignition. Due to the intense heat, the high strength steel cables intended to be used to retrieve the mannequins failed.

Items that were on the floor above the fire room, including the cinder blocks and the firefighter mannequins, fell into the fire room and were severely damaged. The plywood subflooring that was above the joists on the ceiling fell in and can be seen on the right side of figure 15.

Figure 15: Test 4, first unsprinklered test, damage

The damage to the ceiling and the joists is shown in figures 16 and 17.

Almost the entire 16 ft. x 16 ft. ceiling collapsed into the test compartment in a near simultaneous event. The web in most of the composite wood joists was completely consumed by the fire prior to collapse. One of the engineered I-joists that retained a portion of its web is shown in figure 17. The web was almost entirely consumed in the middle and the joist itself was no long capable of supporting a load, leading to collapse. Some examples of engineered I-joists with only the chords left can be seen under the collapsed plywood in figure 16.

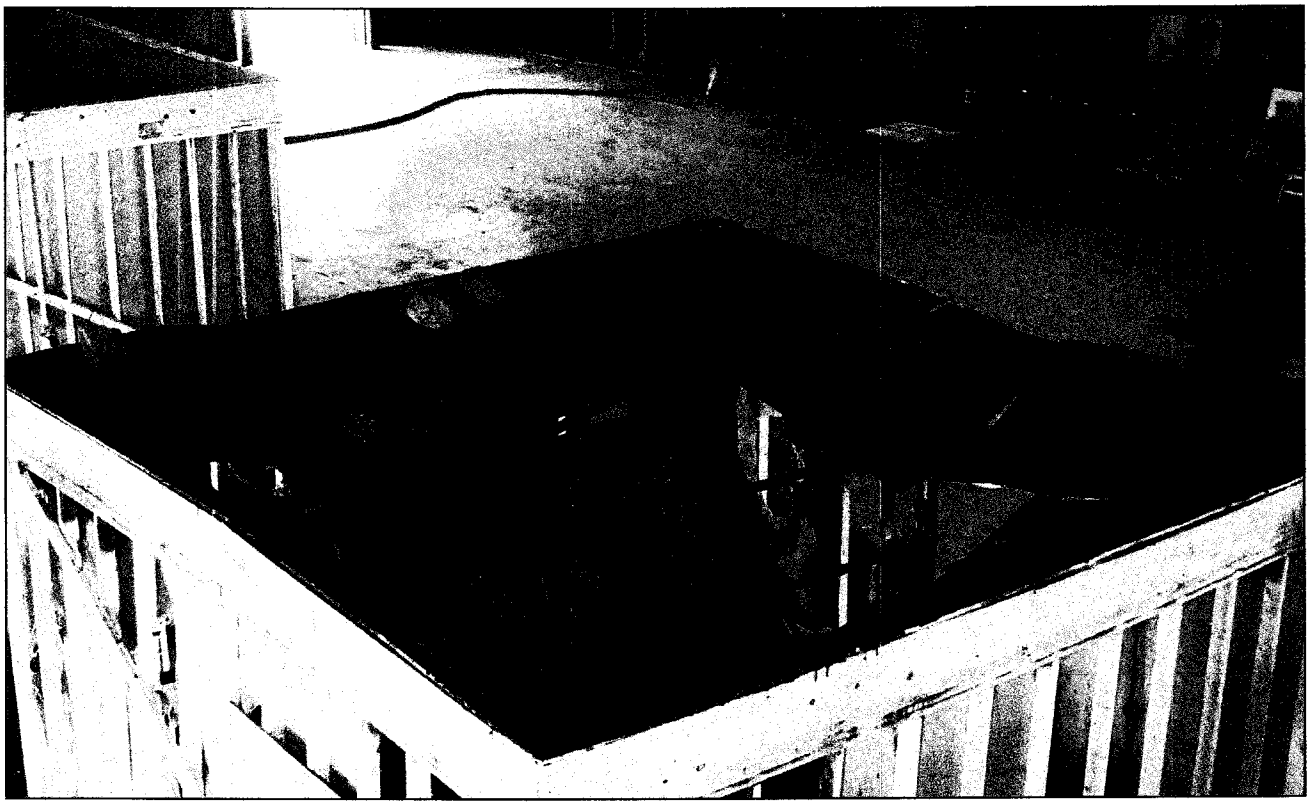

Figure 16: Test 4, first unsprinklered test, roof collapse of structure

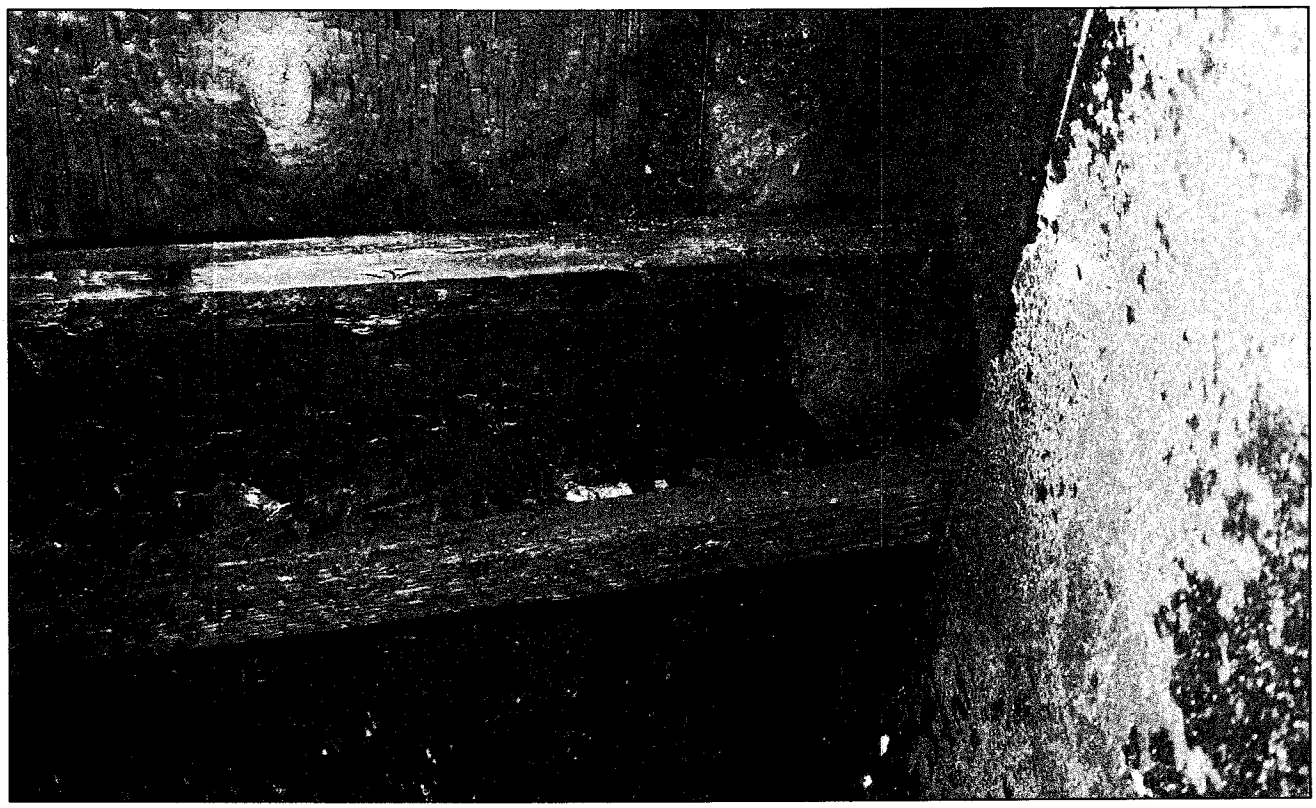

Figure 17: Test 4, first unsprinklered test, one of the few remaining engineered joists on the ceiling. Note how the webbing is almost entirely consumed.

Test 5: Second Unsprinklered "Freeburn" Test with Additional Instrumentation

For the second unsprinklered test, additional instrumentation including 88 more thermocouples (see figures 7 and 8 for location) was included to better understand the progression of the fire through the structure. The additional thermocouples were located in and around the joist as well as in the ceiling/floor assembly layers to understand the heat transfer through and failure mechanism of the ceiling/floor assembly. A Scott Health and Safety Eagle Imager® 160 Thermal Imaging Camera, a type commonly used by firefighters in structure fires, was used to measure the carpet temperature on the floor above. The readings from the thermal imaging camera are one source of information for an incoming firefighter that may provide some warning of impending collapse.

The second unsprinklered test (Test 5) reached flashover conditions only 5:15 from ignition, which was faster than the first freeburn test. It is hypothesized that the fire progressed more rapidly since the loveseat became involved over one minute quicker in the second test. The structure collapsed 8:34 from ignition. The thermal imaging camera that was placed on the standing mannequin transmitted sensible information until shortly after roof collapse. The carpet temperature on the top of the ceiling/floor assembly representing the main level of the house did not start to increase above ambient temperature, recorded by both the thermal imaging camera and the thermocouples located throughout the ceiling/floor assembly, until after flashover occurred. The maximum temperature that both instruments recorded directly before collapse was approximately 147°F. Figure 18 shows a snapshot from the thermal imaging camera shortly before the ceiling/floor assembly collapsed; the thermocouple traces are shown in the Analysis section of this report.

As can be seen from figure 18, the reading of the carpet temperature directly at the target in the middle of the camera is only 147°F shortly before collapse. The doorway from the enclosure is located in the top left of the view and the other hot spots (indicated by the lighter areas) are areas that are beginning to breach. The thermocouple measurements agreed with these findings from the thermal imaging camera.

The fire damage was more extensive in the second freeburn as compared to the first as demonstrated in figure 19. The fire was so intense that although the mannequins were rapidly retrieved after falling through the simulated floor assembly, the turnout gear was destroyed and the underlying plastic forming the mannequin melted. The Scott Health and Safety thermal imaging camera that the standing mannequin was holding also did not transmit sensible data for more than 30 seconds after collapse and was destroyed.

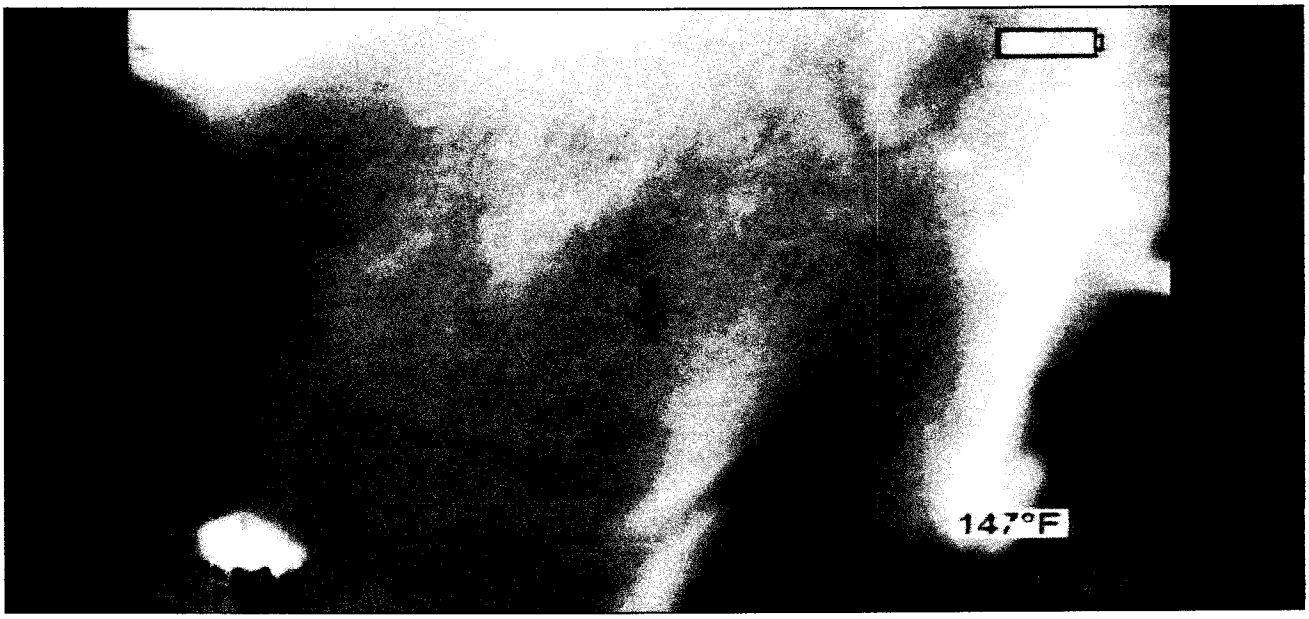

Figure 18: Test 5, second freeburn test, snapshot from the thermal imaging camera shortly before collapse of the structure

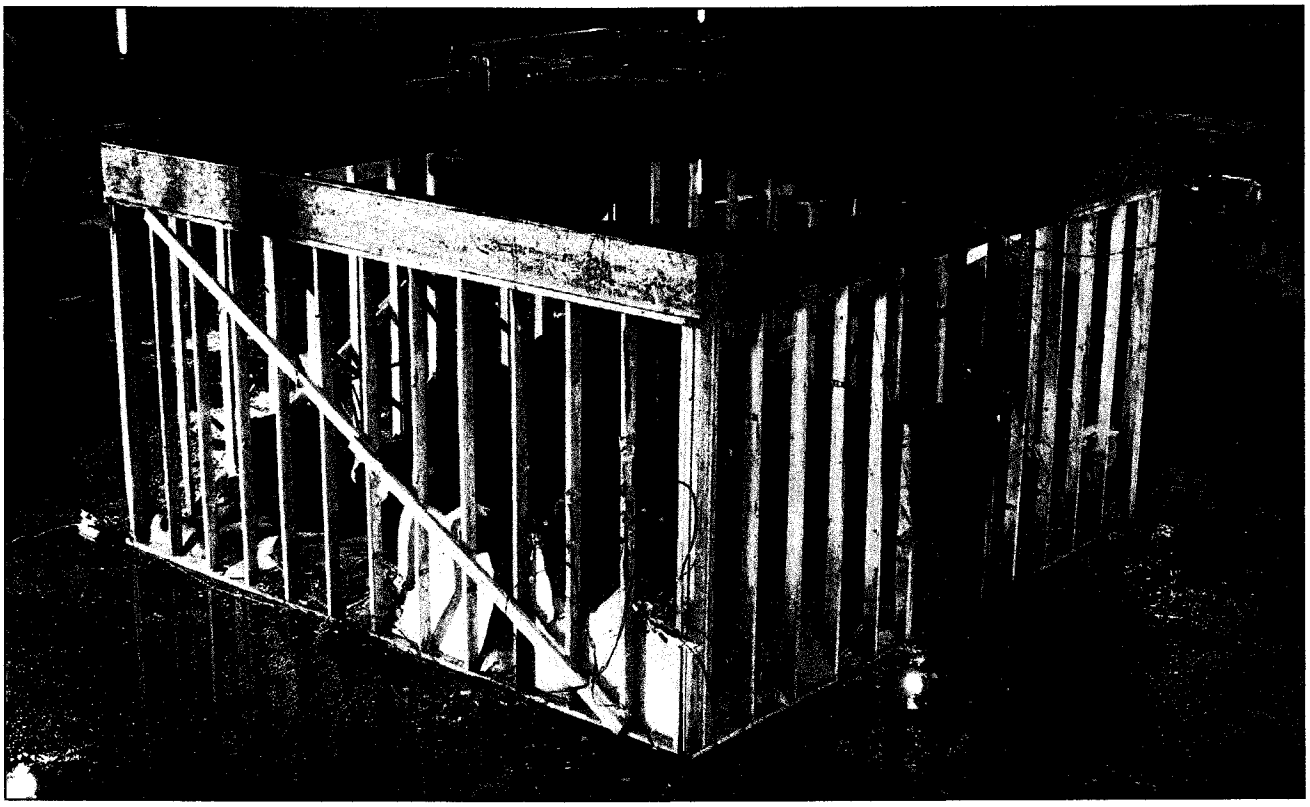

Figure 19: Test 5, second freeburn, damage

Analysis of Results

Temperature

Temperature measurements were taken at 1 ft. intervals in the doorway. The thermocouples near the top of the doorway will record the highest temperatures since they are located in the smoke and, in the case of flashover, fire that exits the room. Figure 20 shows the highest temperatures out the exit as measured by the thermocouple located approximately 1 ft. below the top of the doorway.

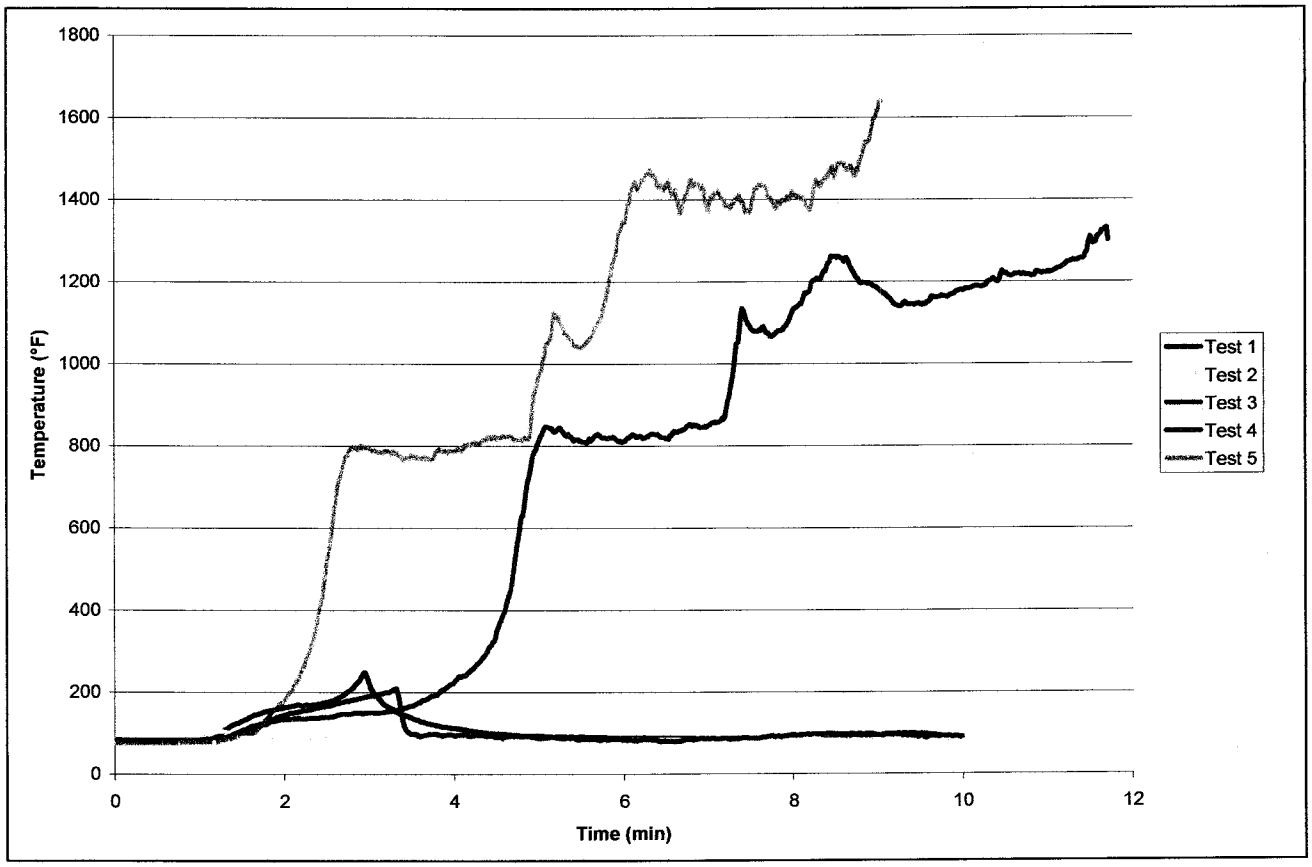

Figure 20: Comparison of temperatures 1 ft. below the top of the doorway

As can be seen from the graph, the temperature in the fires protected by a sprinkler system is less than 250°F throughout the test. A human in a room that has a smoke layer temperature of approximately 250°F or less is very likely to survive according to tenability studies. The smoke layer temperature in the two freeburn tests, however, was approximately 800°F before flashover and subsequent flame extensions out the doorway at 7:09 and 5:15, respectively. After this time, the thermocouple is reading a flame temperature of approximately 1200-1400°F. The freeburn represents a situation that is not survivable based on heat alone after only approximately 2-5 minutes (depending on the test) from ignition. Since the toxic gas levels were not measured, it is not known to what degree they would contribute to the hazardousness of the space. If the toxic gas levels and the oxygen depletion in the room were considered in addition to the heat recorded by the thermocouples, the room would likely have been deemed untenable much quicker than the 2-5 minutes previously stated.

Radiation

One of the criteria to determine flashover is a reading of over 20 kW/m^2 from a floor mounted radiometer. A radiometer was installed in the floor next to the coffee table in the approximate center of the room with a field of view toward the ceiling for all five tests. The readings from the radiometer for the two unsprinklered tests and all of the sprinklered tests are shown in figures 21 and 22, respectively; note the difference in scale on the vertical axis.

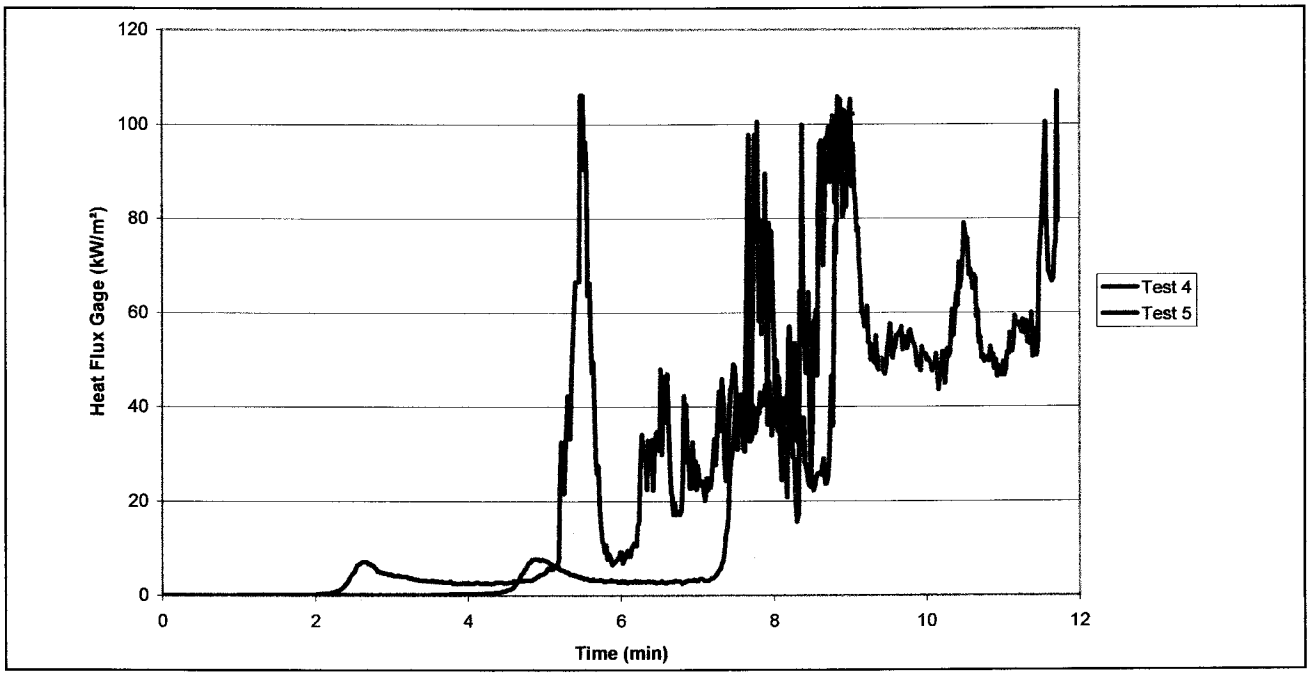

Figure 21: Reading from radiometer located on floor for both unsprinklered tests

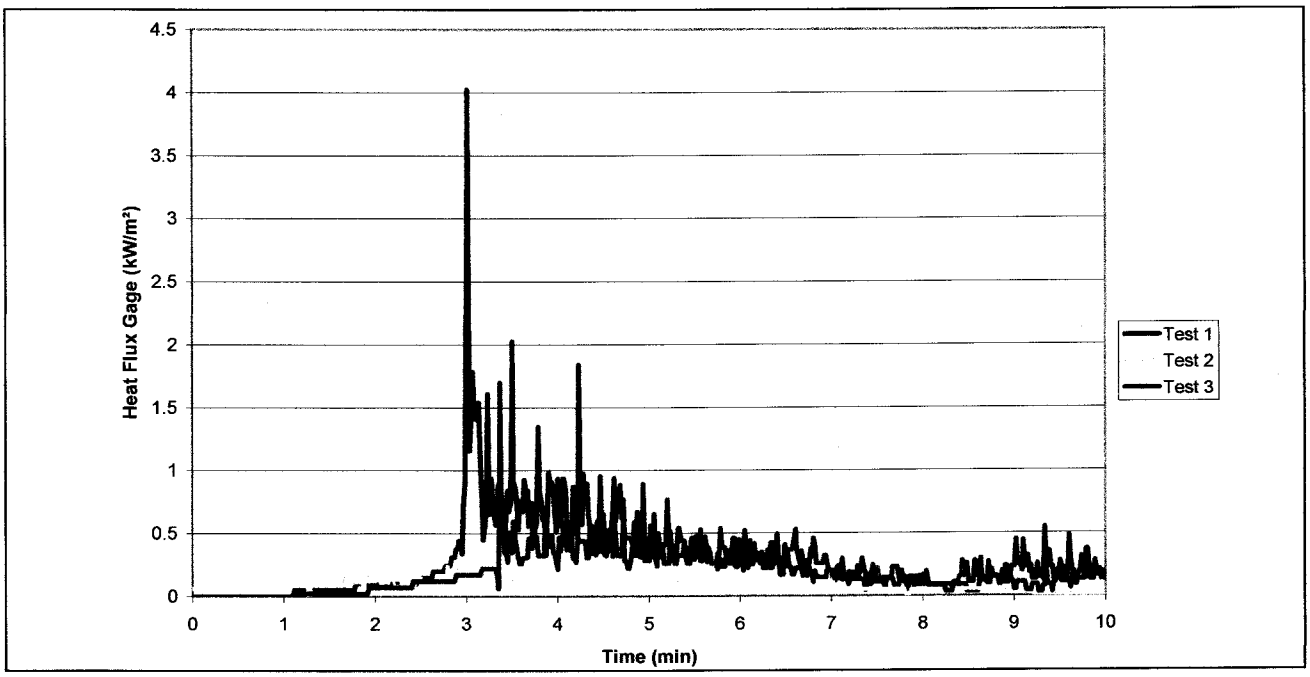

Figure 22: Reading from radiometer located on floor for all sprinklered tests

As can be seen from the graph, the radiometer readings in the sprinklered tests are much lower than for the unsprinklered tests. The flame extension out the doorway which represented a visual indication of flashover is verified by the radiometer reading since it increases over 20 kW/m^2 around 7 and 5 minutes from ignition for the first and second freeburn, respectively. In the sprinklered tests, there was a spike up to 4 kW/m^2 that lasted for less than 10 seconds while all other readings from the sprinklered tests registered at a maximum of 2 kW/m^2. The readings from the radiometer again demonstrate that the survivability of the space and the protection of the contents in the room are enhanced with sprinkler protection.

Additional Instrumentation

The additional instrumentation for the second freeburn test (Test 5) provided valuable information on the temperature rise through the ceiling/floor assembly. The ceiling/floor assembly temperatures did not vary significantly at the different locations (see graphs in Appendix A); the temperature traces for location 1 (closest to the fire) are shown in figure 23.

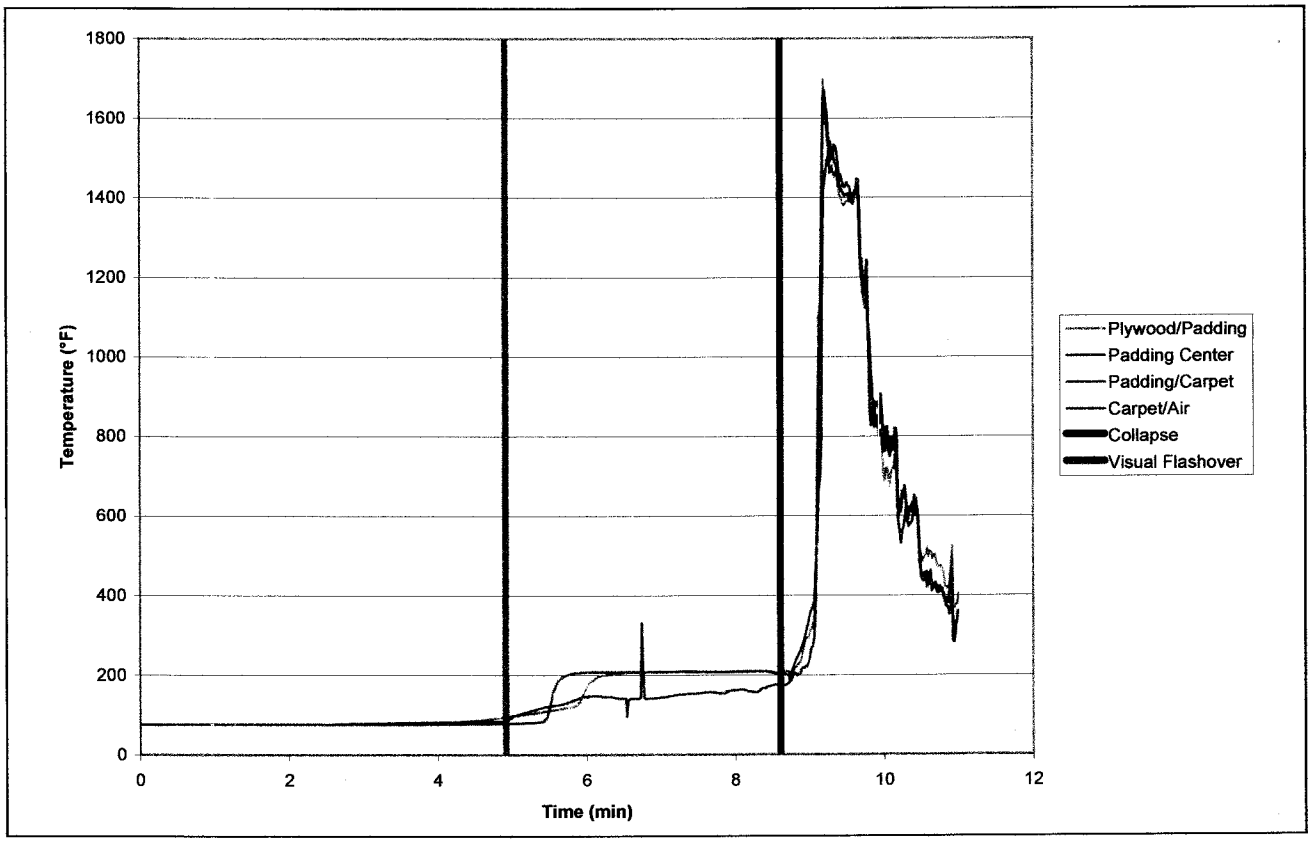

Figure 23: Ceiling/Floor assembly temperatures at the location closest to the fire

The thermocouples at all of the interfaces (refer to figure 8 for exact placement) are shown in the figure except for the thermocouple on the fire side of the plywood. The red vertical line represents visual flashover (i.e. flaming out the doorway) while the black vertical line represents the time of collapse. The thermocouple on the fire side of the plywood sheathing closely mimicked the temperature in the room. However, the temperature on the other side of the 7/8 in. plywood sheathing was much cooler. This indicates that the plywood layer was acting as the primary blocking layer for heat transfer through the ceiling/floor assembly.

Also, the temperature at the carpet/air interface (i.e. on top of the carpet above the enclosure) closely matched

the reading from the Scott Health and Safety thermal imaging camera that the standing mannequin was holding. The temperature traces matched up to the point of collapse. The thermal imaging camera does not output temperature versus time in data form but it is available as a display in the video (as can be seen from figure 14) and was compared at key points throughout the test to the thermocouple readings. Figure 24 shows the readings from the thermal imaging camera and the thermocouples located at the carpet/air interface up to the point of collapse at the three closest thermocouple locations (see figure 7 for diagram of locations).

Similar to the readings from the thermal imaging camera, the thermocouples did not report a temperature increase above ambient until after flashover and did not rise above 200°F until after collapse. The temperatures on the floor above the fire provide no indication of collapse, even immediately prior to the event.

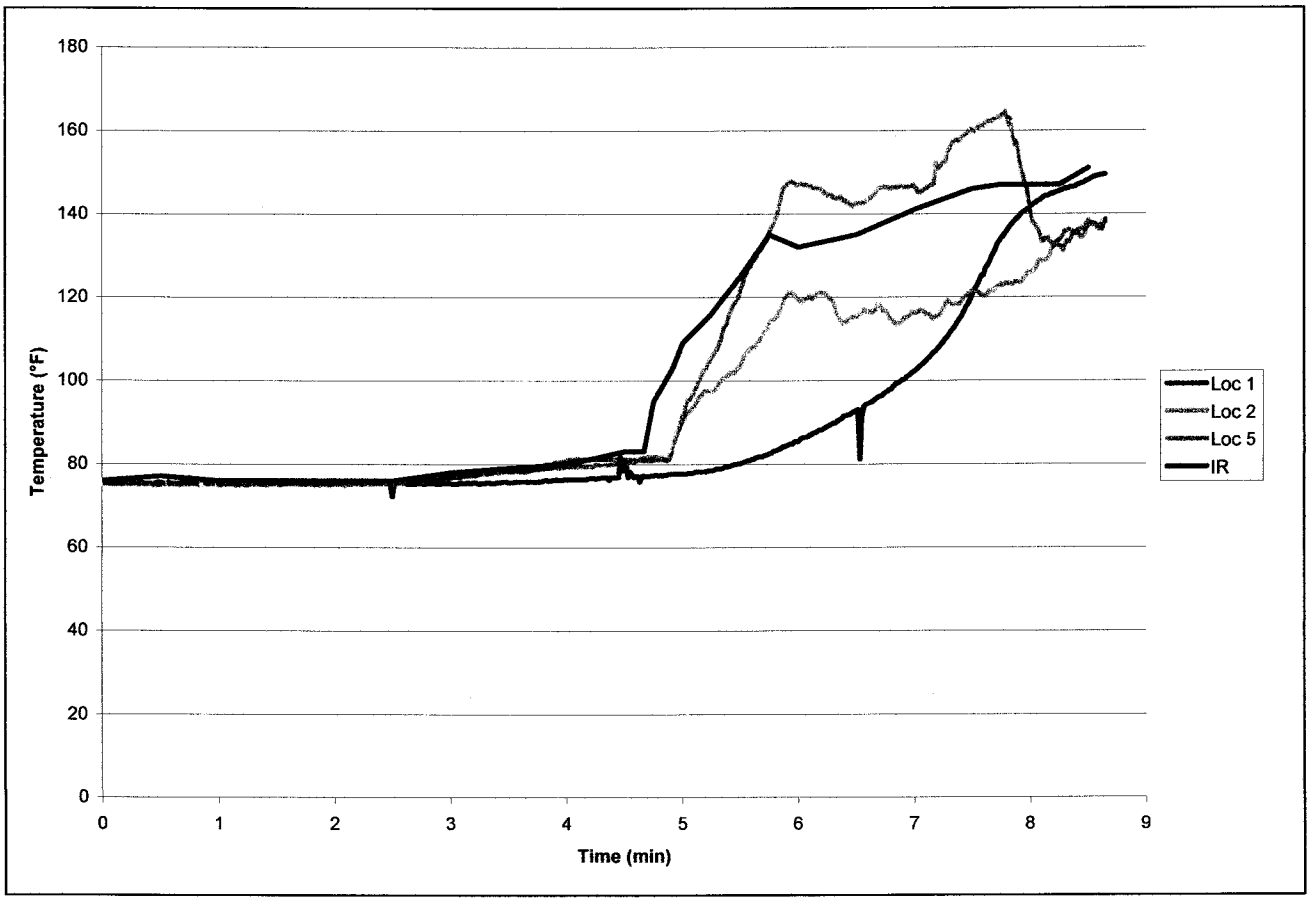

Figure 24: Comparison of temperatures recorded by the thermocouples and the thermal imaging camera on the top of the enclosure up to the point of collapse

Conclusions

The results from this test series demonstrate that exposed, lightweight composite wood joists are likely to fail three to five minutes after compartment flashover for structures with typical residential loadings. Further, the time to collapse as measured from the start of flaming combustion for the fire scenarios employed in this test series was between 8 and 12 minutes. This relatively small timeframe prior to the failure of exposed composite wood joists may require the fire service to adopt alternative tactics and procedures for structures built using lightweight construction methods.

This test program further highlights the dramatic differences between the sprinklered and unsprinklered scenarios, as demonstrated through photographs, observations and data collected. All of the information presented shows that the addition of a sprinkler system can greatly enhance life safety of both residents and firefighters and aid in property protection. Today's homes contain more products with higher heat release rates than in previous years and the construction of these homes has become less fire resistant due to the use of lightweight construction materials. This combination has proven to be deadly for firefighters.

Although not directly studied as part of this current project, other options exist for increasing the performance of exposed, lightweight construction materials. For example, the building codes could be updated to include requirements for listed fire-rated ceiling/floor assemblies or require fire resistant sheathing such as sheetrock over lightweight load bearing assemblies. Either of these options would increase the time to failure of the ceiling/floor assembly and increase civilian and firefighter safety. A less attractive option would be the elimination of the use of lightweight construction materials altogether.

Based on the composite wood joist performance demonstrated in this test program, combined with the history of firefighter injuries and deaths associated with lightweight construction materials, consideration should be given to methods which will permit responding fire fighters to clearly and rapidly identify the types of construction methods and materials employed in any structure. One method to accomplish this notification is through the placarding of buildings using a predetermined system of signs and symbols. Further, firefighters should be trained to understand the differences in the fire behavior of structures resulting from various construction techniques.

The current study includes evaluation of the use of sprinkler systems to enhance life safety and property protection in lightweight construction typical of contemporary residential structures. Currently, the majority of civilian fire deaths and injuries occur in the victim's own home. Every year firefighters are injured and killed while fighting residential type fires in single and multiple family dwellings. This test series indicates that sprinklers provide life safety advantages not just to dwelling occupants, but also to firefighters. Building codes need to continue to include and enhance the safety of members of the fire service and other first responders, particularly in the area of improving the fire performance of composite wood joists and other lightweight construction materials and techniques.

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Tarley, Jay, Rich Braddee and Ted Fehr. "Career Engineer dies and Fire Fighter injured after falling through floor while conducting a primary search at a residential structure fire – Wisconsin." NIOSH Report, July 2007. <http://www.cdc.gov/niosh/fire/reports/face200626.html>.

About the Author

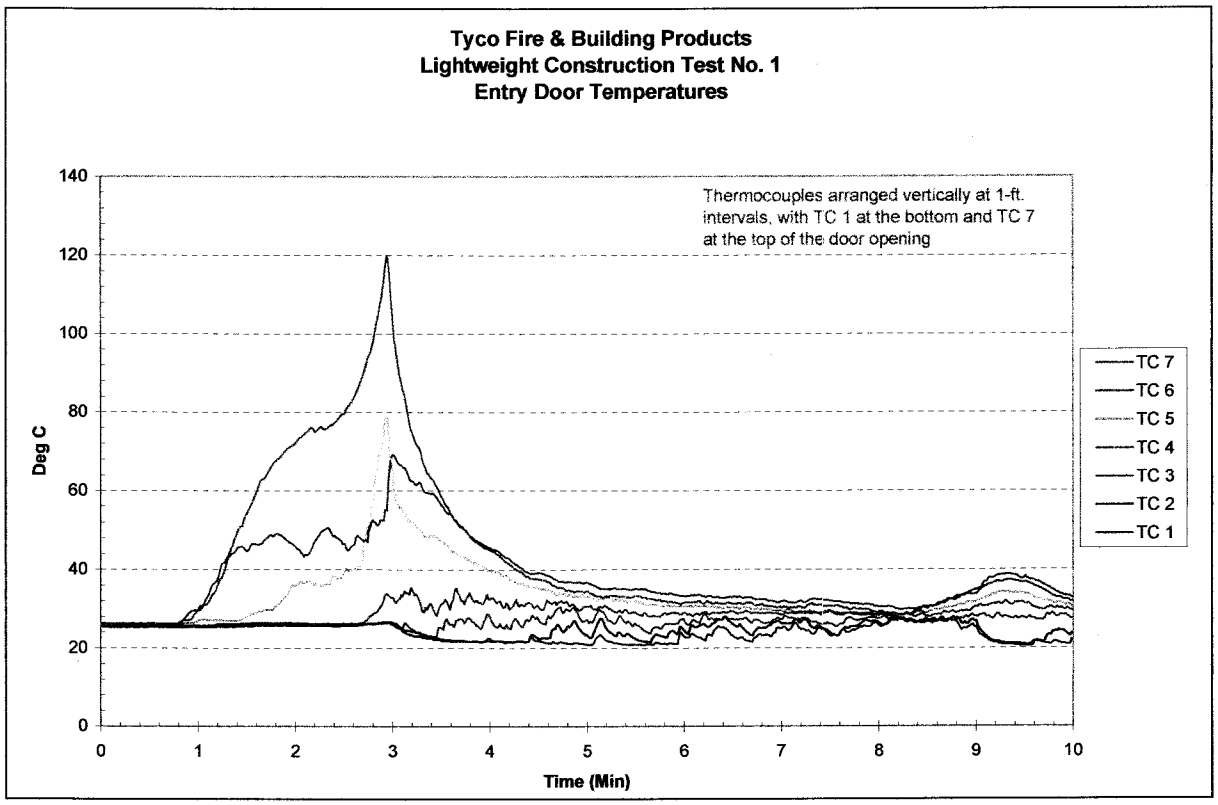
Melissa Avila is a Project Engineer in the New Technology Group of Tyco Fire Suppression & Building Products located at the Global Technology Center in Cranston, Rhode Island. As a graduate of Worcester Polytechnic Institute's Mechanical and Fire Protection Engineering programs, Melissa completed a Master's thesis on the study of the behavior of composites in small scale fire environments and has two papers published in the composites literature on the subject. Since being employed by Tyco in March 2007, Melissa has been involved in a wide range of projects exploring and enhancing the performance of fire suppression systems.

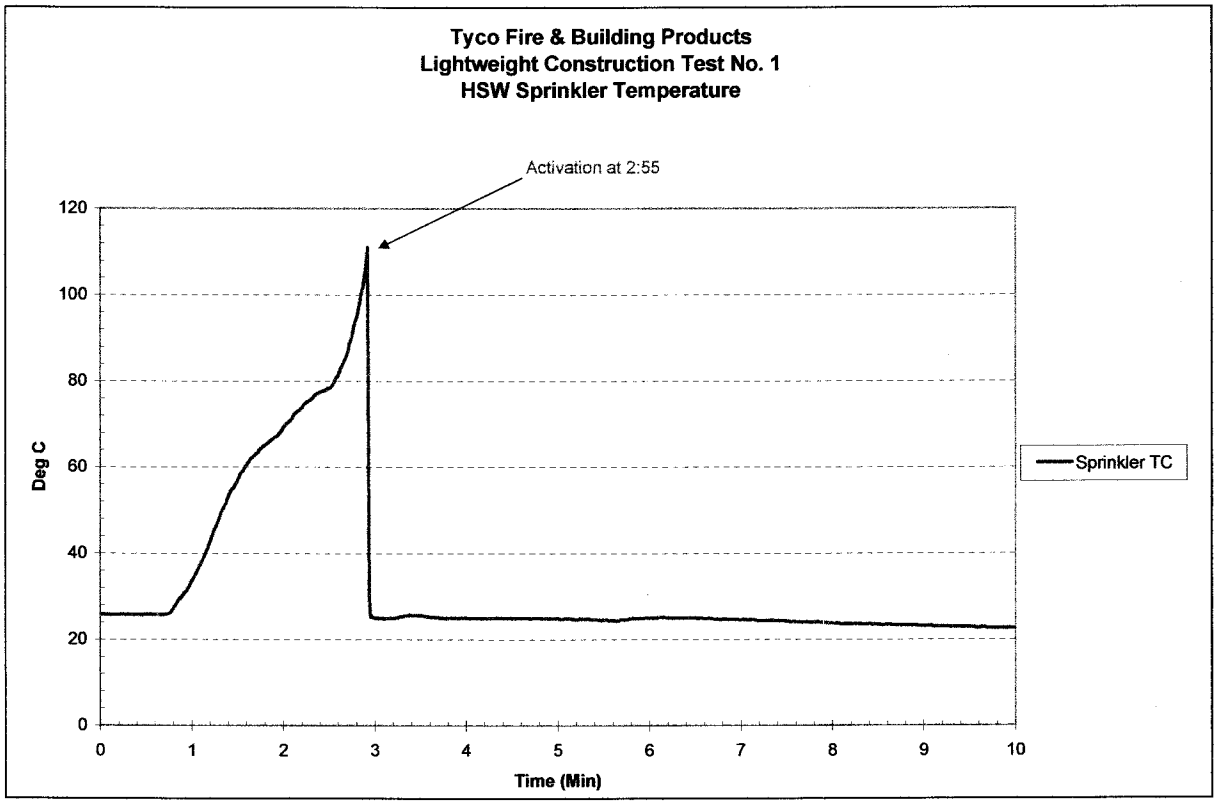
APPENDIX A: Data from UL Tests (As Provided)

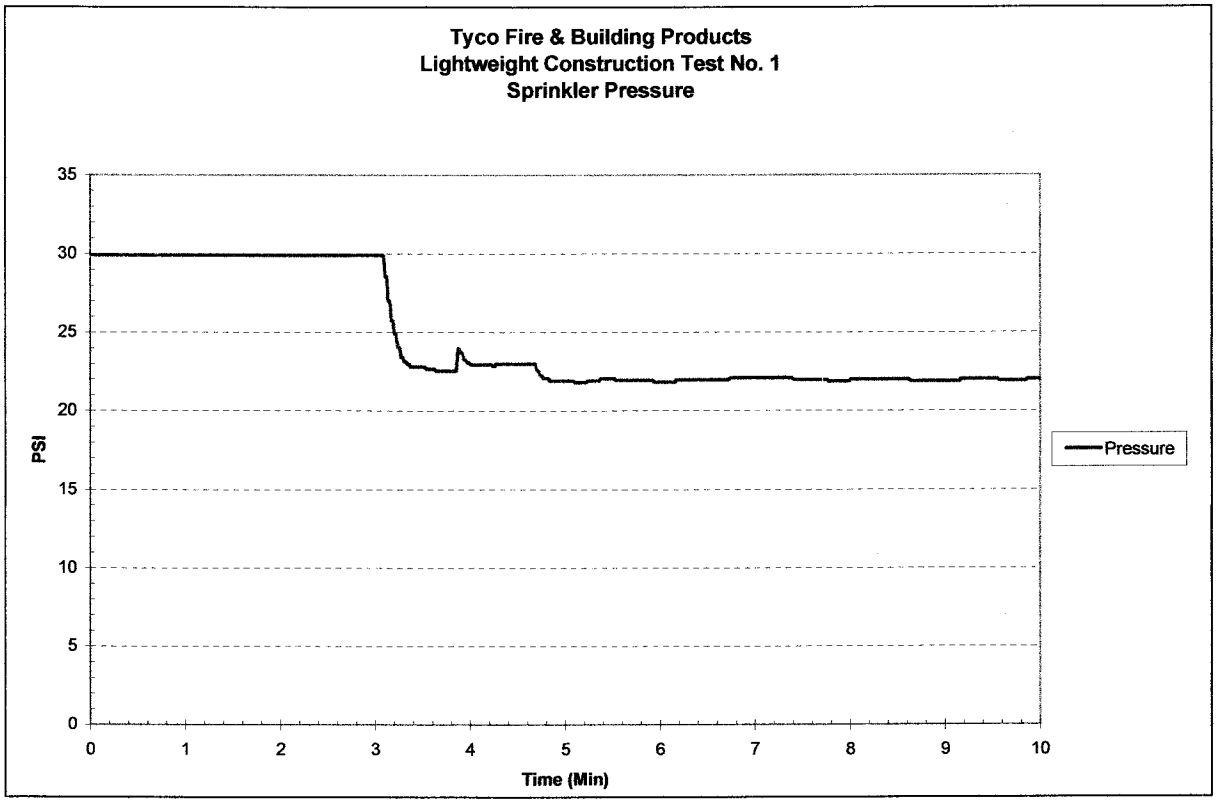
TEST 1: 4.2K Residential Horizontal Sidewall

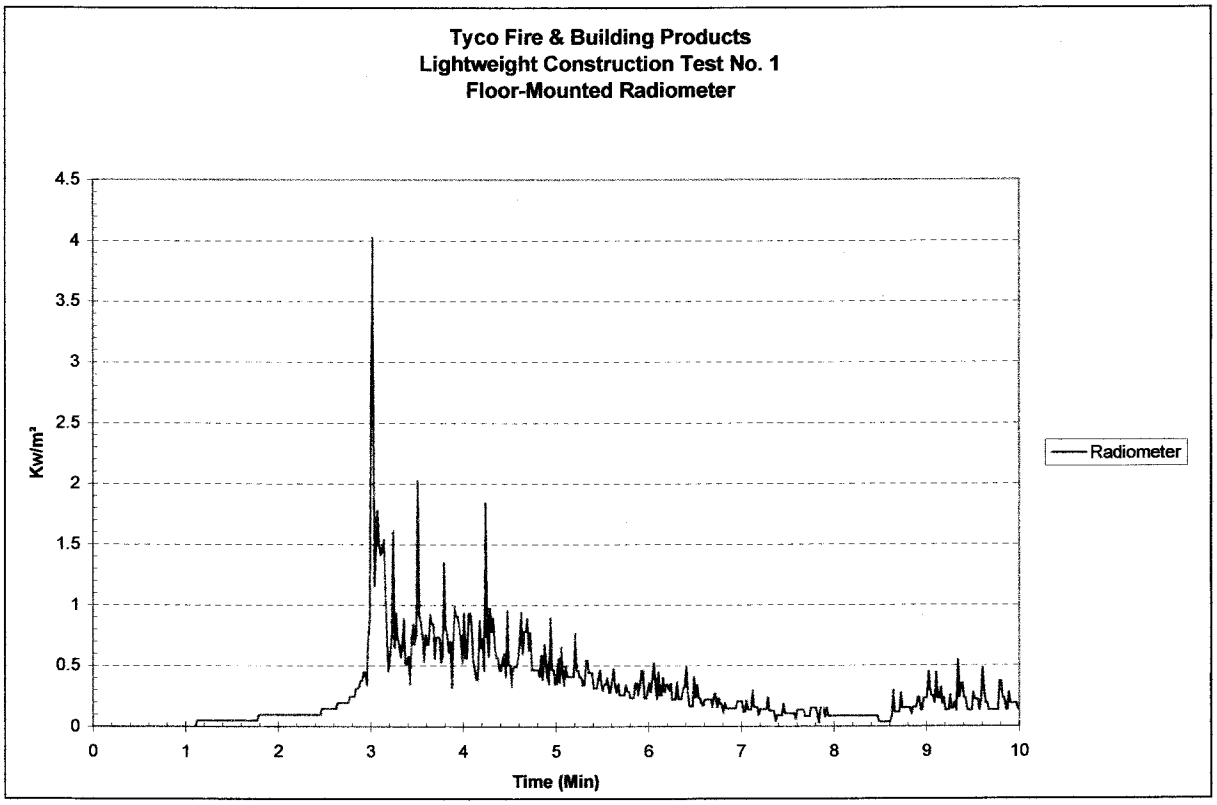
July 15, 2008 at Underwriters Laboratories, Northbrook, IL

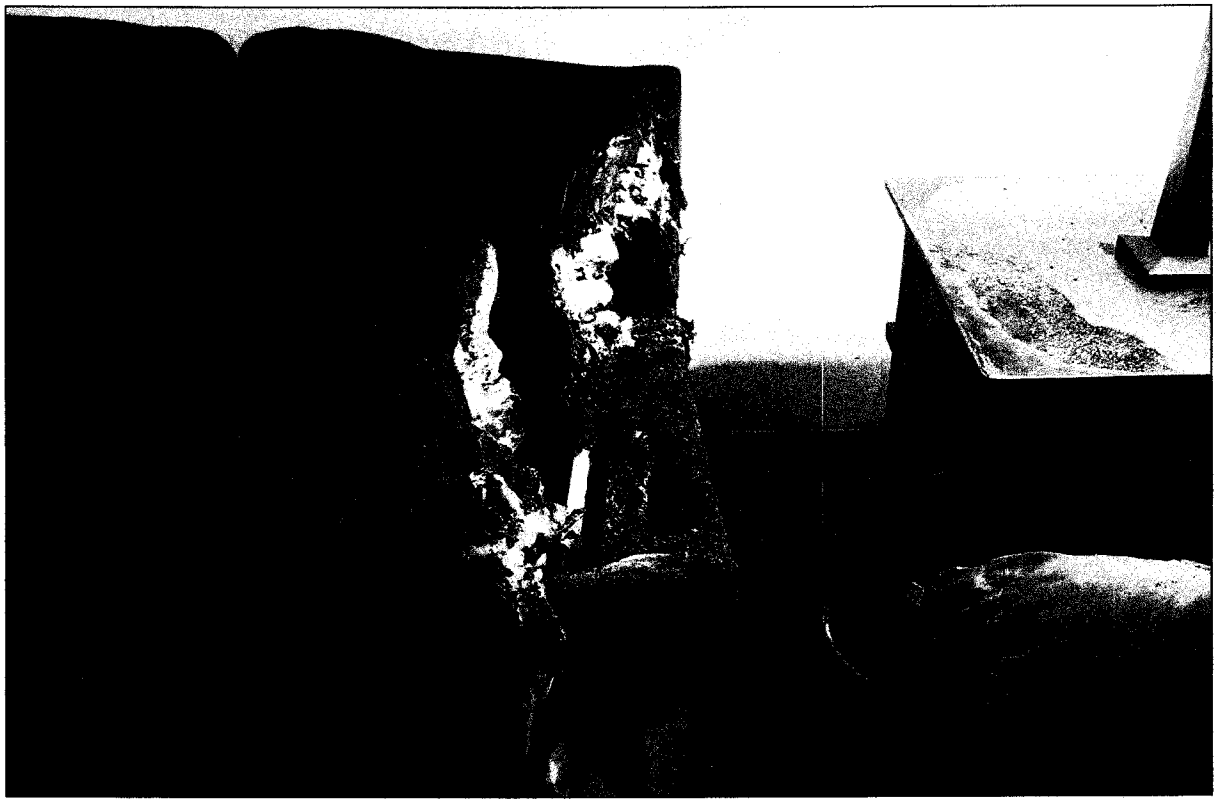
- Composite wood joists sheathed in 2 layers of 1/2 in. sheetrock
- One horizontal sidewall sprinkler
  - TY1334, 4.2K LFII residential
  - 155°F
  - 5 in. below ceiling
  - Centered on wall with entertainment center (farthest wall from fire)
  - 20 gpm (22.7 psi)
- Sprinkler operated at 2:55
- Control achieved between 4-5 minutes after ignition
- Minor damage




Tyco Fire & Building Products
Lightweight Construction Test No. 1
HSW Sprinkler Temperature
Activation at 2:55
Deg C
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
Time (Min)
Sprinkler TC


Tyco Fire & Building Products
Lightweight Construction Test No. 1
Sprinkler Pressure
PSI
35
30
25
20
15
10
5
0
0
1
2
3
4
5
6
7
8
9
10
Time (Min)
Pressure



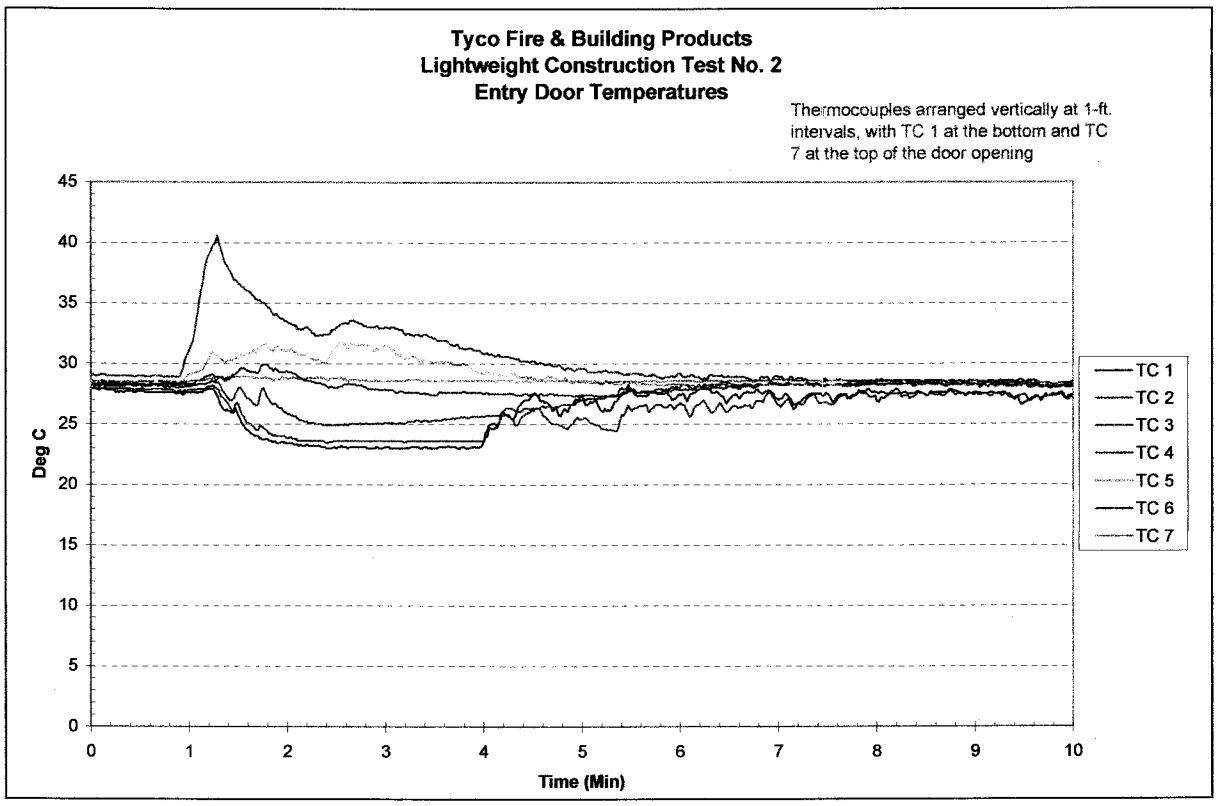


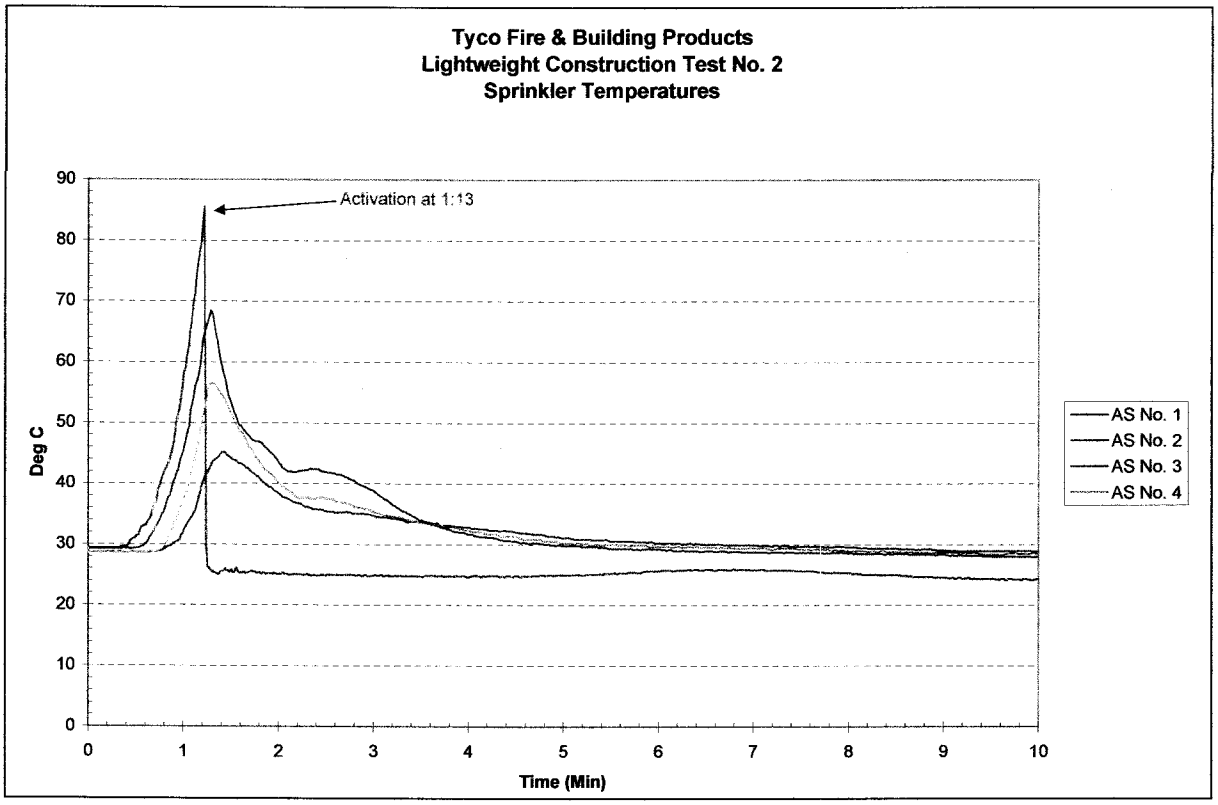
Test 1 Damage Assessment

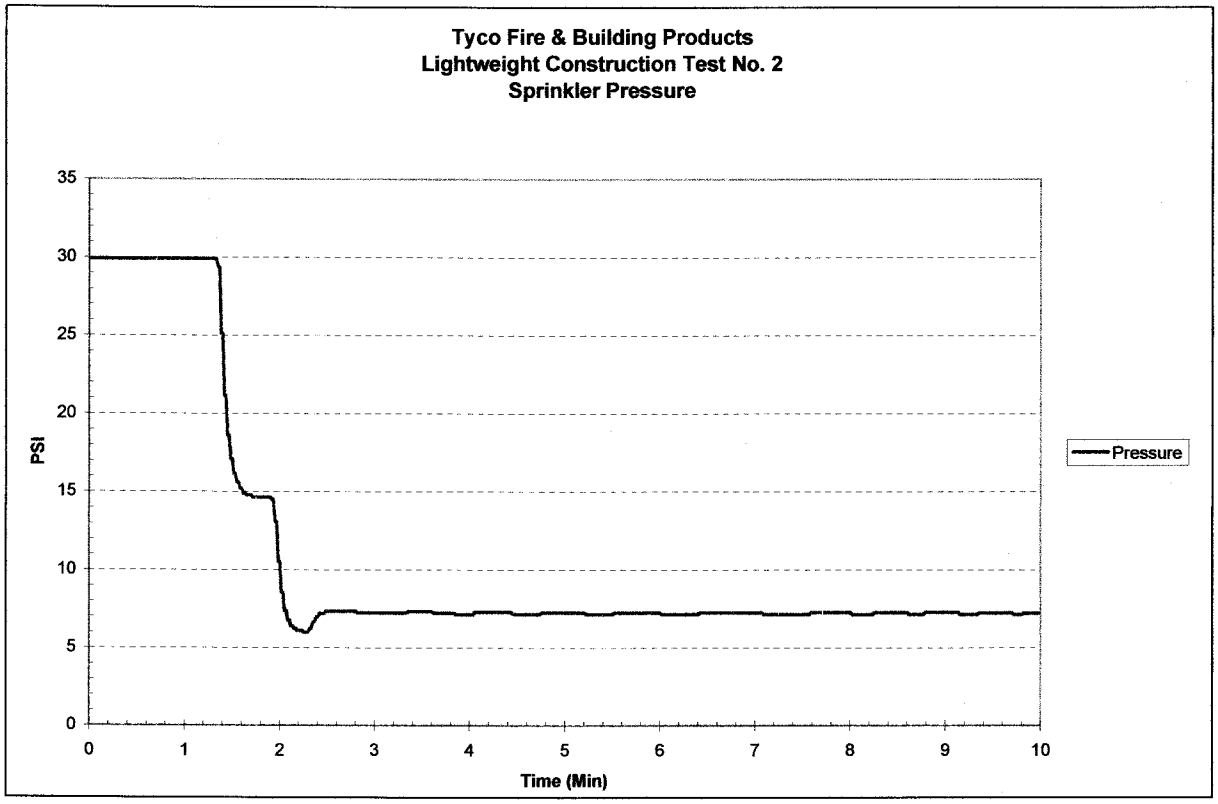
TEST 2: 4.9K Residential Pendent Sprinklers with 64 ft^2 Coverage Area

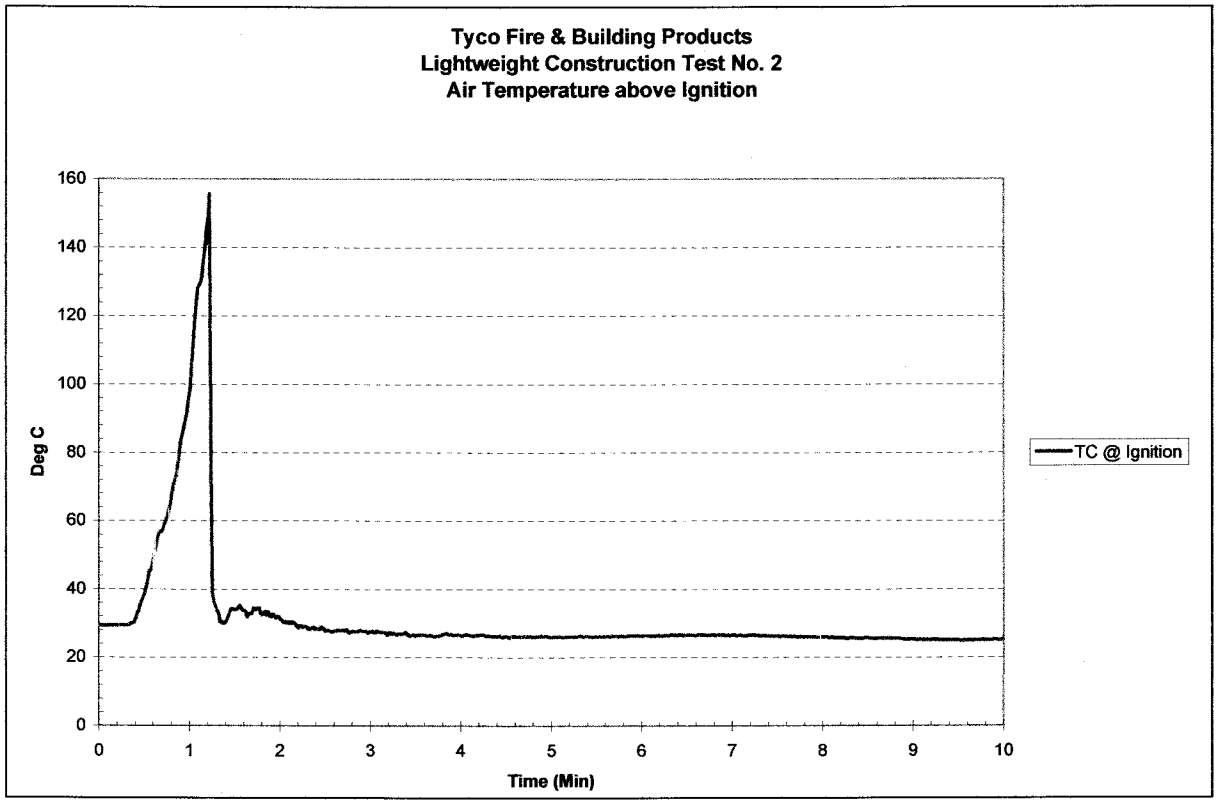
July 16, 2008 at Underwriters Laboratories, Northbrook, IL

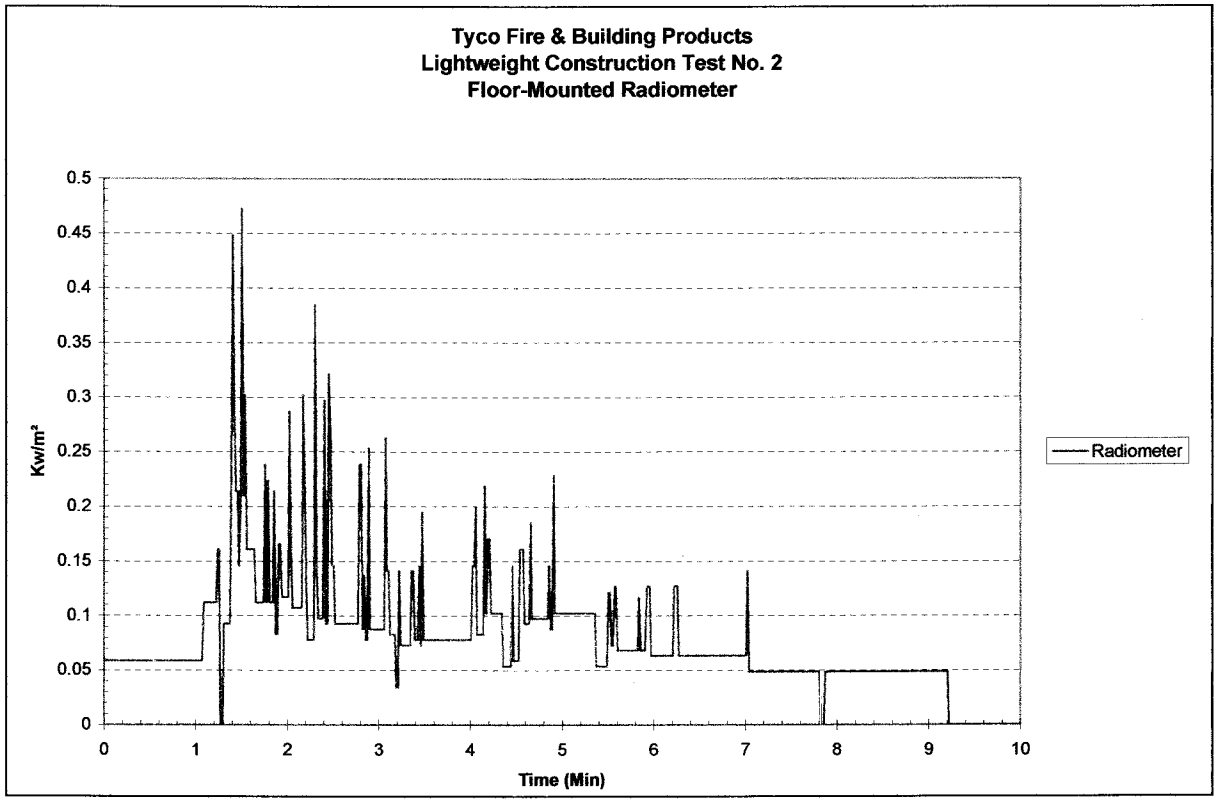
- Exposed Joists
- Four pendent sprinklers
  - -TY2234, 4.9K LFII residential
  - -155°F
  - -8 ft. spacing
  - -4 ft. from each corner
  - -13 gpm (7 psi)
- Only one sprinkler operated
- Sprinkler operated at 1:13
- Control achieved between 3-4 minutes after ignition
- Minor damage

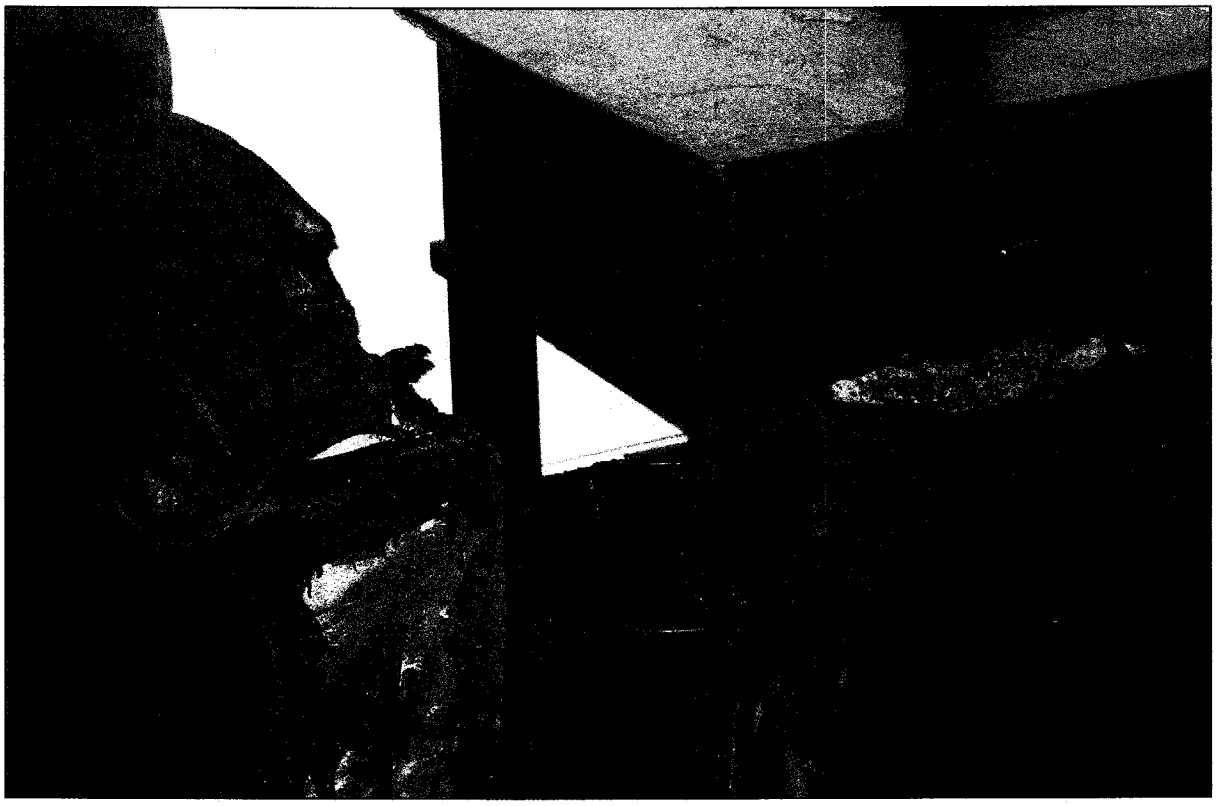



Tyco Fire & Building Products
Lightweight Construction Test No. 2
Sprinkler Temperatures
Activation at 1:13
Deg C
Time (Min)
AS No. 1
AS No. 2
AS No. 3
AS No. 4


Tyco Fire & Building Products
Lightweight Construction Test No. 2
Sprinkler Pressure
PSI
Time (Min)
Pressure


Tyco Fire & Building Products
Lightweight Construction Test No. 2
Air Temperature above Ignition
Deg C
160
140
120
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
Time (Min)
TC @ Ignition


Tyco Fire & Building Products
Lightweight Construction Test No. 2
Floor-Mounted Radiometer
Kw/m²
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
1
2
3
4
5
6
7
8
9
10
Time (Min)
Radiometer

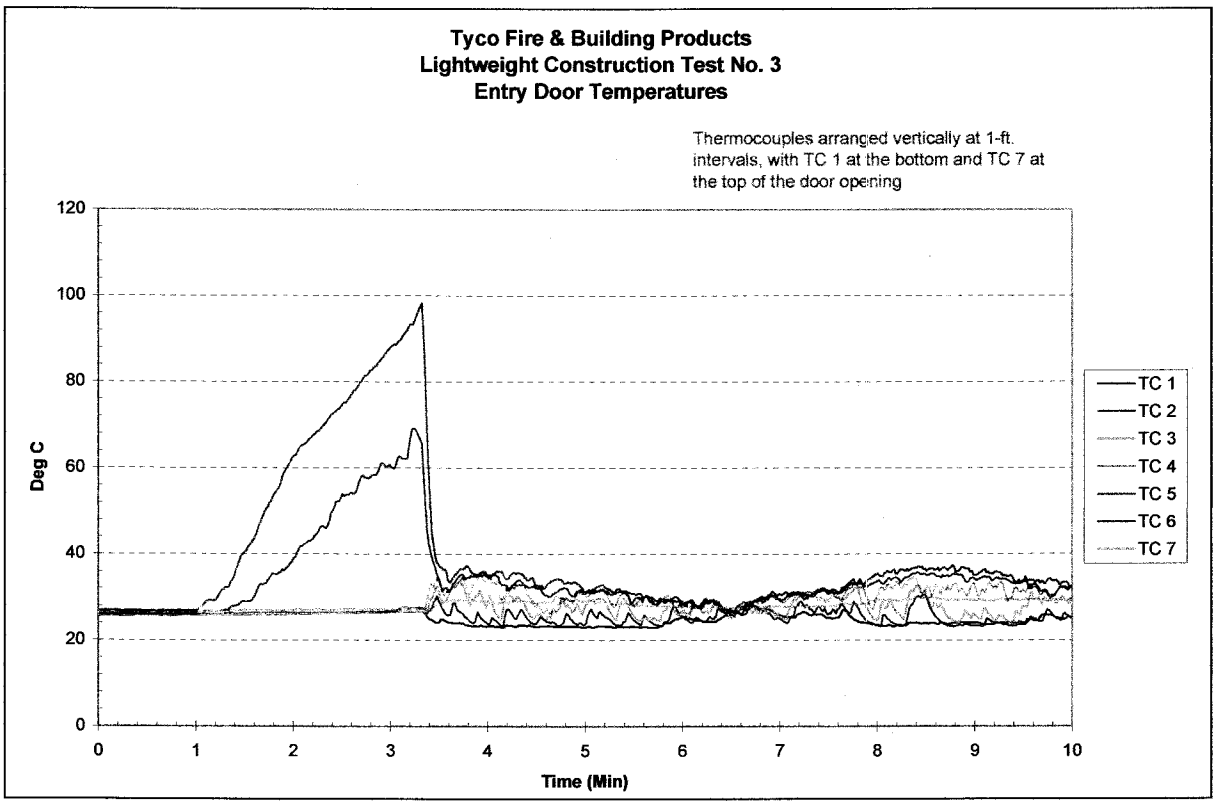


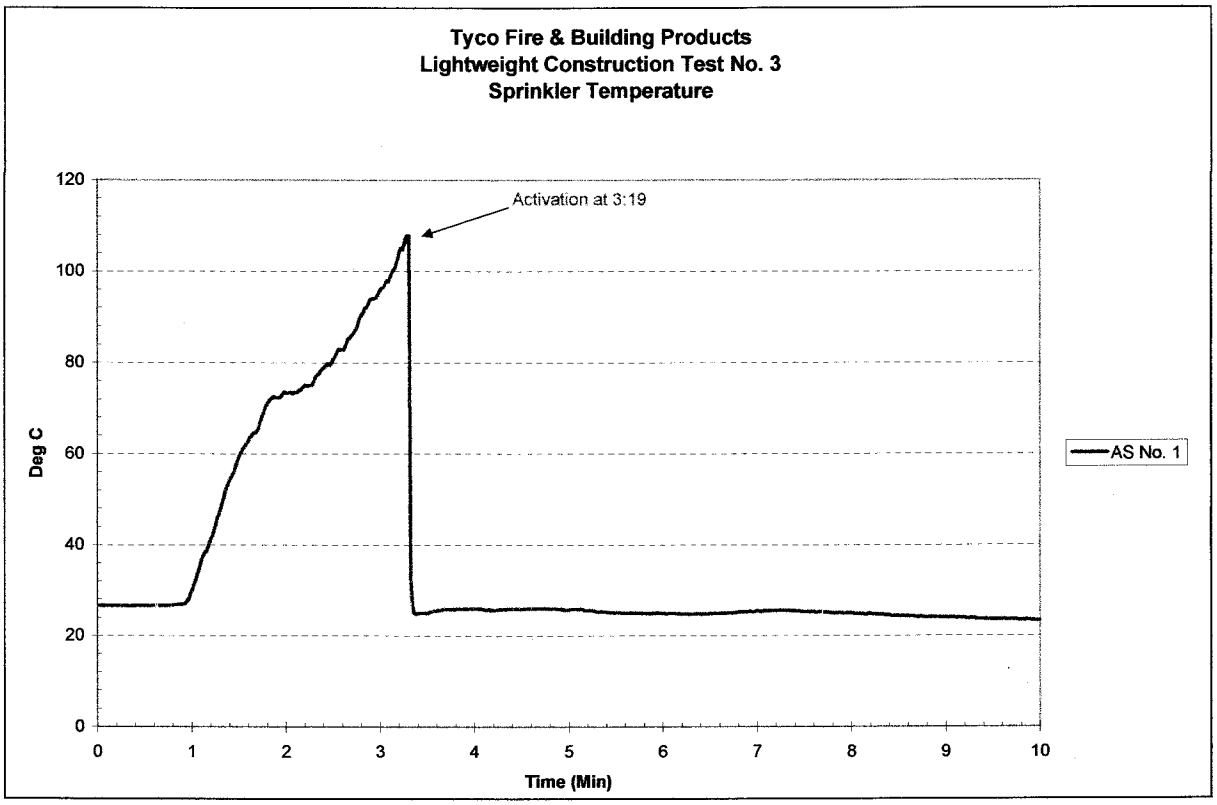
Test 2 Damage Assessment

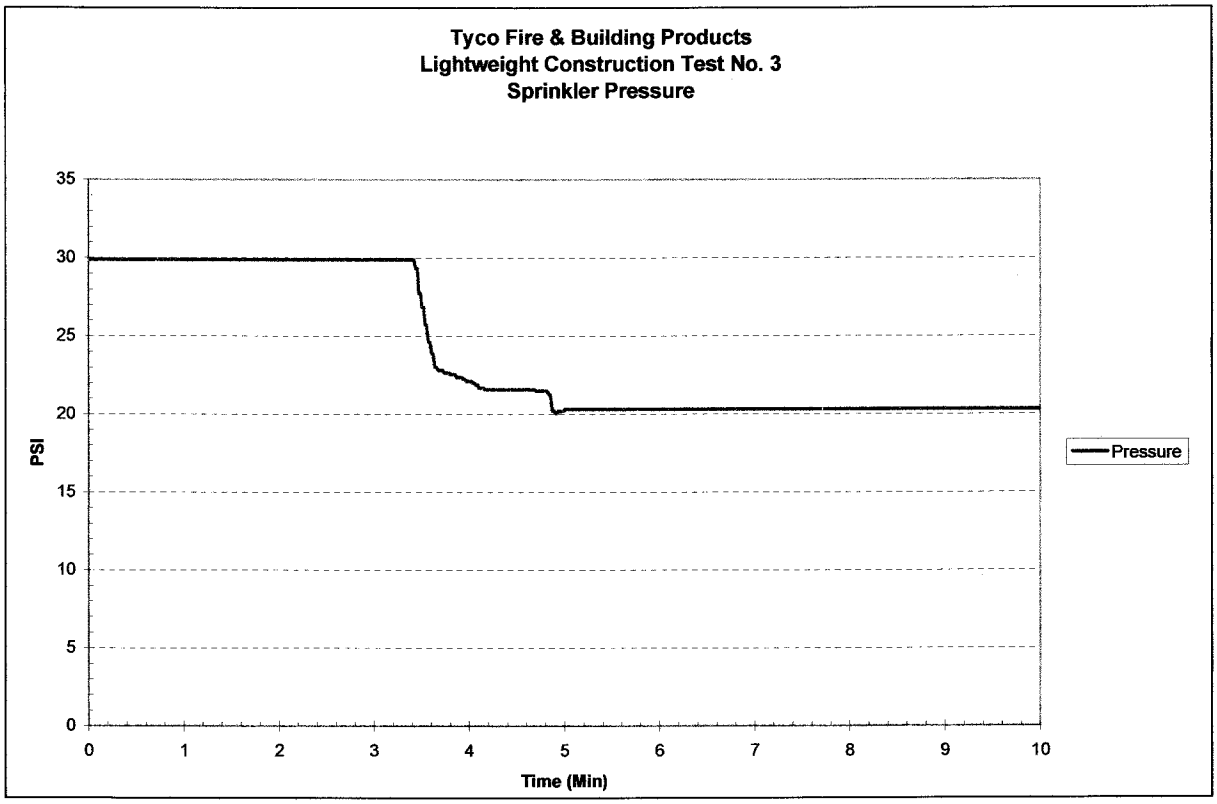
TEST 3: 4.9K Residential Pendent Sprinkler with 256 ft^2 Coverage Area

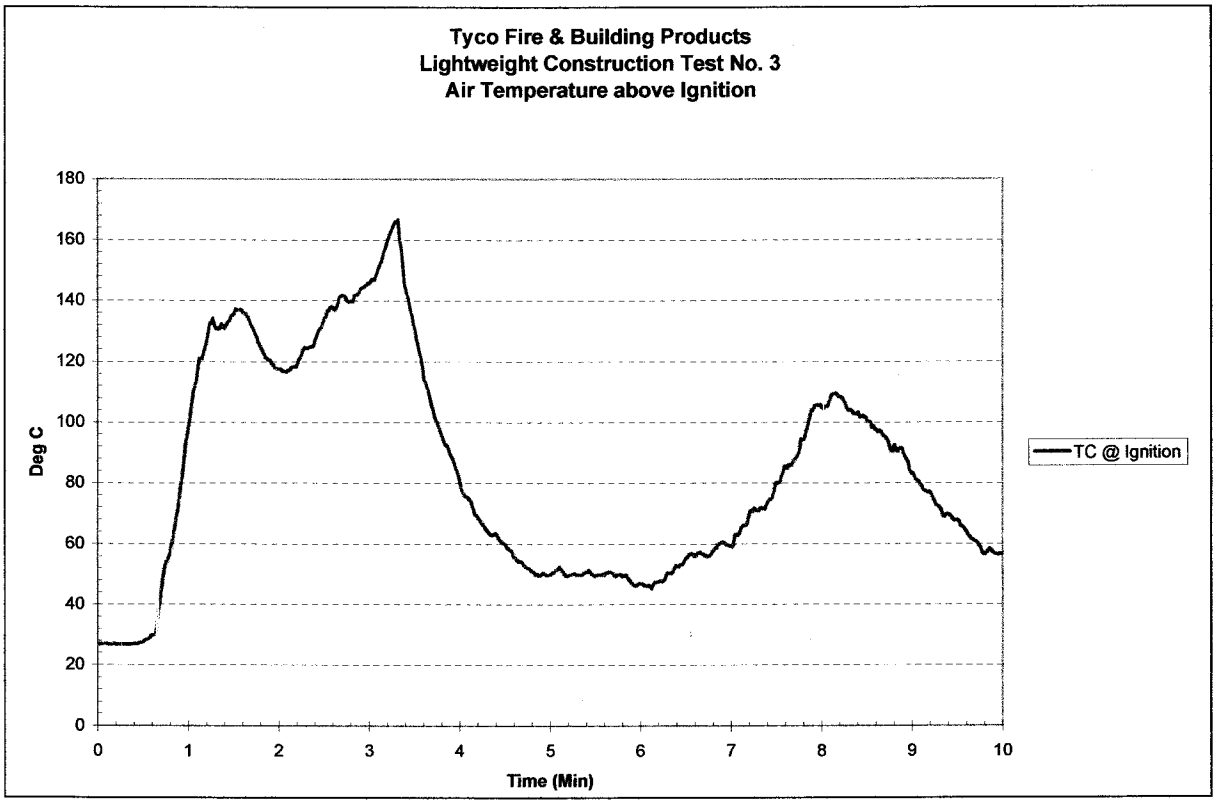
July 17, 2008 at Underwriters Laboratories, Northbrook, IL

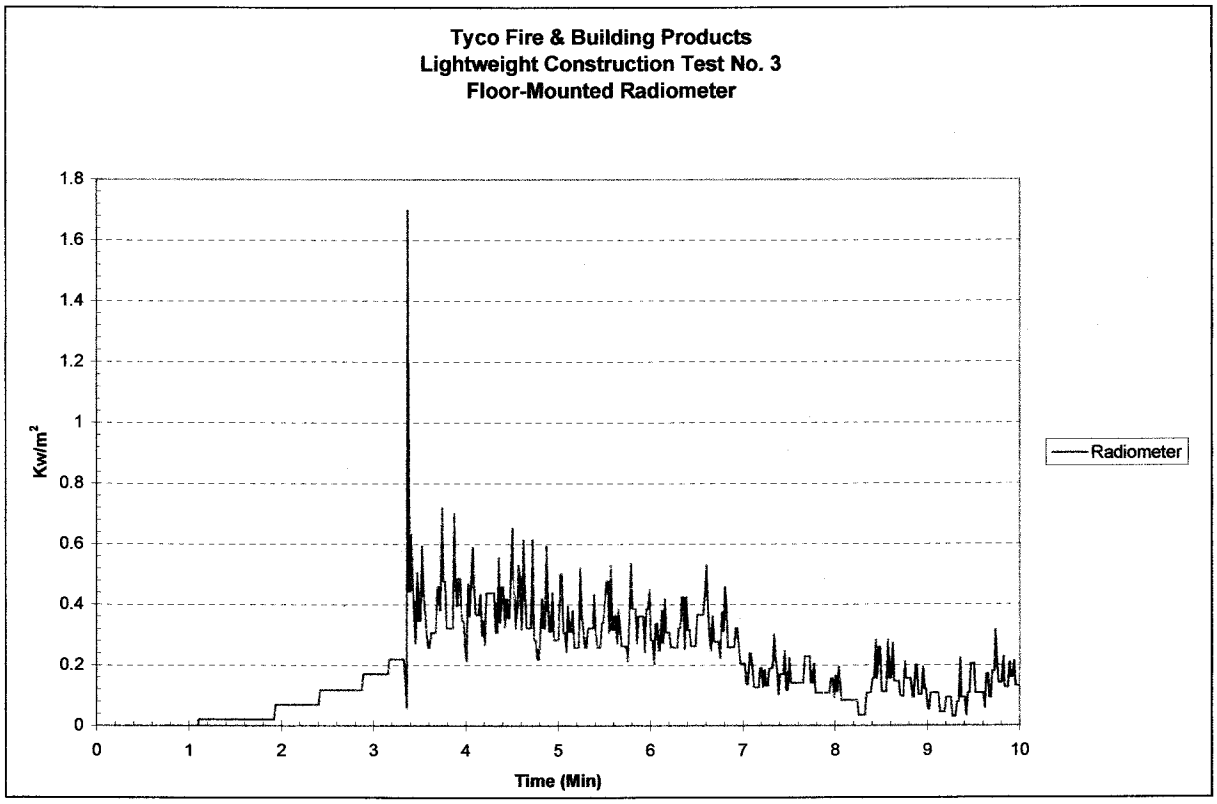
- Exposed Joists
- One pendent sprinkler
  - -TY2234, 4.9K LFII residential
  - -155°F
  - -6 ft. spacing
  - -Center of the room
  - -22 gpm (20 psi)
- Sprinkler operated at 3:19
- Control achieved between 3:30-4:30 minutes after ignition
- Minor damage

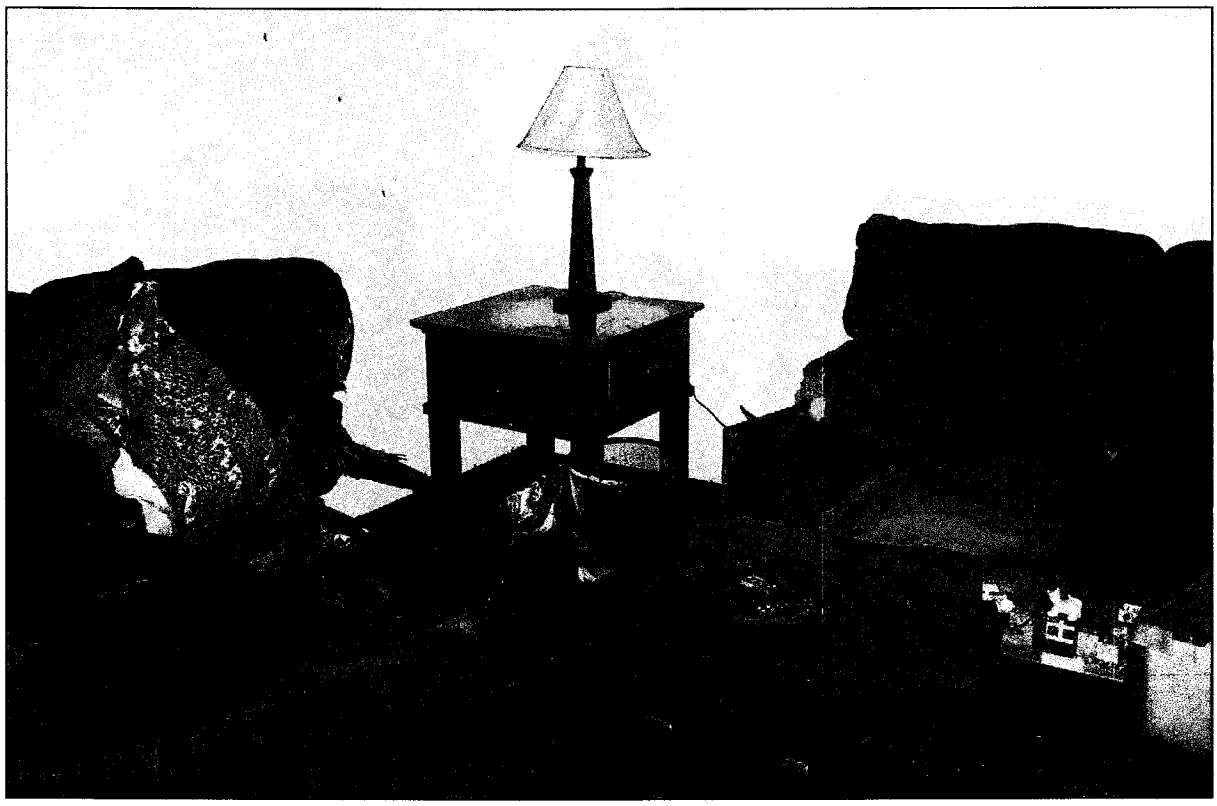



Tyco Fire & Building Products
Lightweight Construction Test No. 3
Sprinkler Temperature
Activation at 3:19
Deg C
Time (Min)
AS No. 1
0
20
40
60
80
100
120
0
1
2
3
4
5
6
7
8
9
10


Tyco Fire & Building Products
Lightweight Construction Test No. 3
Sprinkler Pressure
PSI
Time (Min)
Pressure
0
5
10
15
20
25
30
35
0
1
2
3
4
5
6
7
8
9
10


Tyco Fire & Building Products
Lightweight Construction Test No. 3
Air Temperature above Ignition
Deg C
Time (Min)
TC @ Ignition

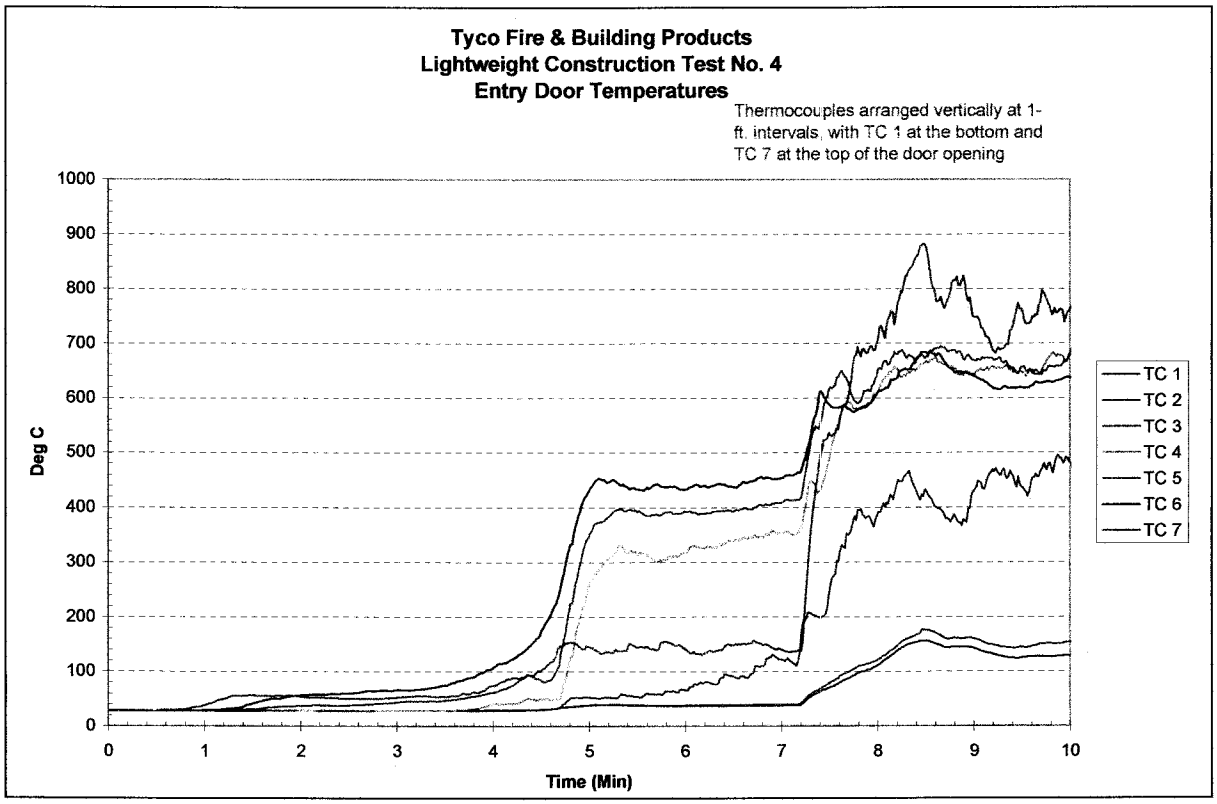

Tyco Fire & Building Products
Lightweight Construction Test No. 3
Floor-Mounted Radiometer
Kw/m2
Time (Min)
Radiometer

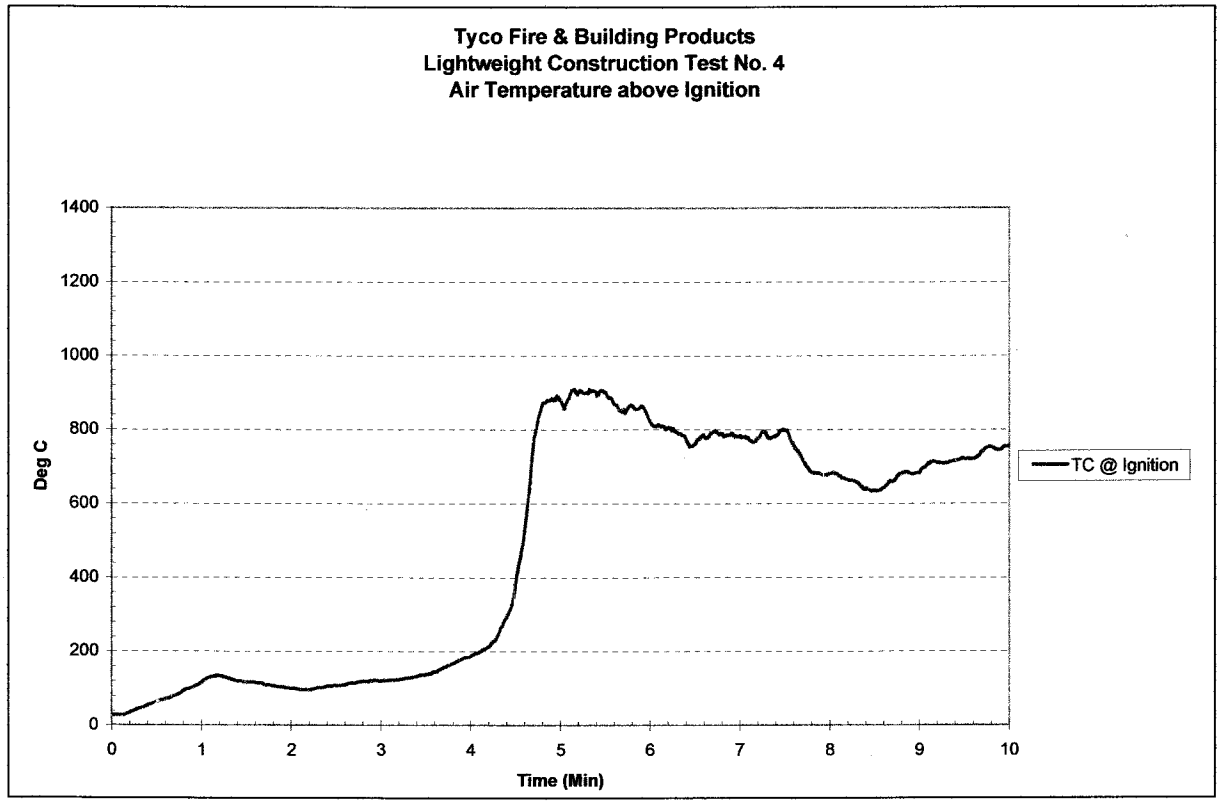


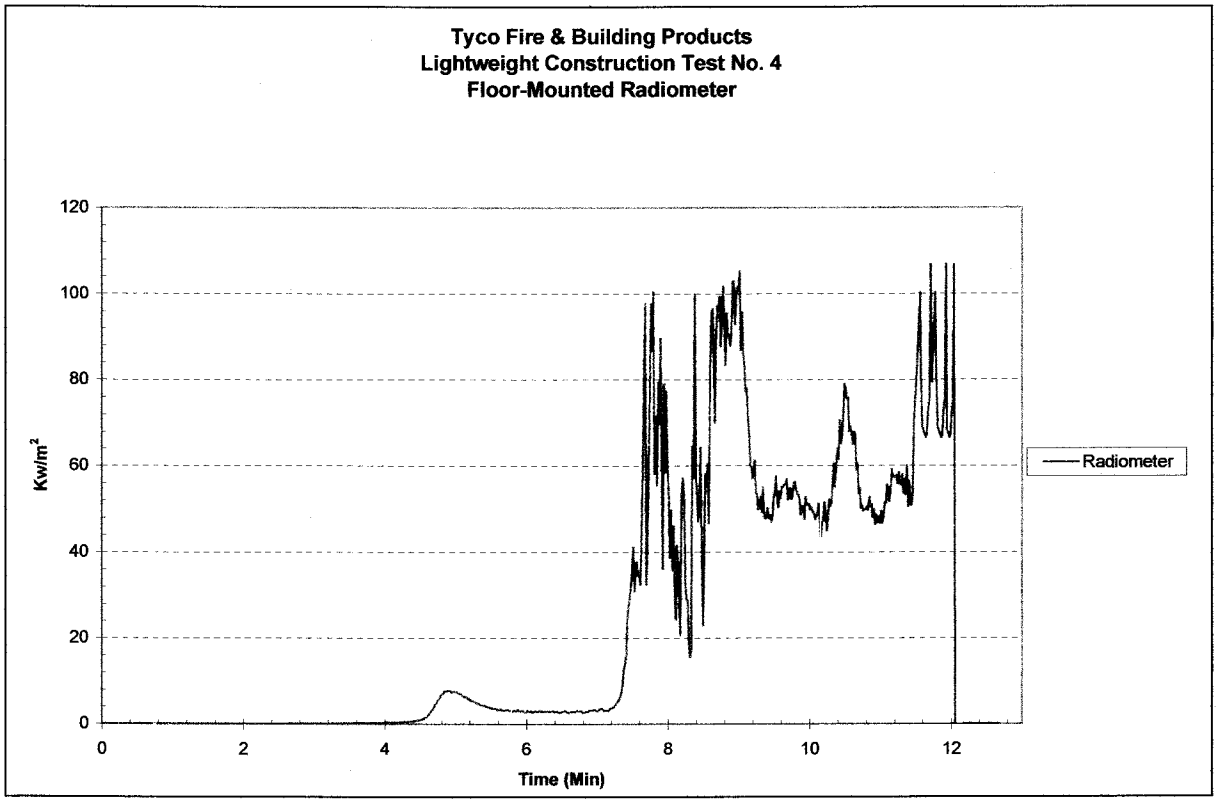
Test 3 Damage Assessment

TEST 4: First Unsprinklered "Freeburn" Test

- July 17, 2008 at Underwriters Laboratories, Northbrook, IL
- Exposed Joists
- No sprinkler protection
- Room brought until collapse
- Flashover occurred at 7:09 from ignition
- Collapse occurred at approximately 11:30 from ignition
- Excessive damage, roof collapse




Tyco Fire & Building Products
Lightweight Construction Test No. 4
Air Temperature above Ignition
Deg C
1400
1200
1000
800
600
400
200
0
0
1
2
3
4
5
6
7
8
9
10
Time (Min)
TC @ Ignition


Tyco Fire & Building Products
Lightweight Construction Test No. 4
Floor-Mounted Radiometer
Kw/m²
120
100
80
60
40
20
0
0
2
4
6
8
10
12
Time (Min)
Radiometer

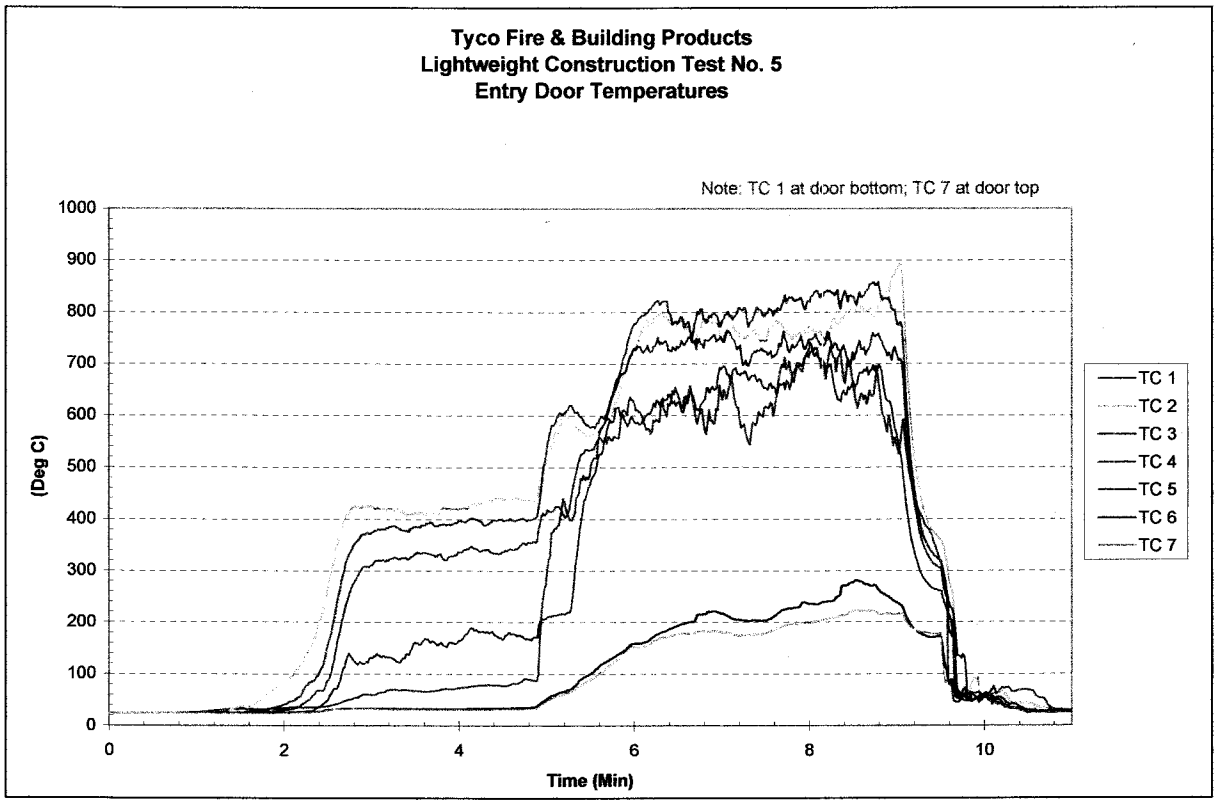
Gas Values From 0 to 312 seconds	Peak Gas	Peak SEC	Avg Gas	Avg SEC	SEC at Peak Gas
Acetylene	23.5	2	3.75	0.48	2
Acrolein	98.3	8.6	5.61	0.69	8.6
Acrylonitrile	43.3	29.6	6.42	4.46	29.6
Ammonia	0.2	16.4	0.03	1.04	0.1
Benzene	3.5	6.2	0.65	1.44	6.2
Carbon Dioxide	9790	260.1	3754.81	70.01	260.1
Carbon Monoxide	2048.7	0	554.05	0	0
Ethylene	297.3	8.3	20.72	0.63	8.3
Formaldehyde	49.7	9.1	6.22	0.76	9.1
Hydrogen Bromide	3	19.9	0.41	5.96	17.7
Hydrogen Chloride	59	25.7	3.46	2.6	25.7
Hydrogen Cyanide	302.5	19.1	47.24	4.28	19.1
Hydrogen Fluoride	0.1	5.9	0	0.68	0.2
Methane	319.7	8.6	28.98	0.73	8.6
Nitric Oxide	40.5	3.19E+07	26.78	2.76E+07	3.18E+07
Nitrogen Dioxide	128.8	52.1	9.9	4.08	52.1
Nitrous Oxide	31.8	3.2	8.07	0.57	2.5
Phenol	2.4	5	0.5	0.79	1.4
Phosgene	0	0.7	0	0.04	0.7
Propane	13.8	7.9	0.8	0.74	7.9
Silicon Tetrafluoride	0	0.5	0	0.03	0.5
Styrene	45	13.5	1.89	2.3	13.5
Sulfur Dioxide	27	4.4	1.34	1.28	4.4
Toluene Diisocyanate	28.6	0.9	12.53	0.38	0.9
Water	30.8	146.3	1.68	58.86	9.8

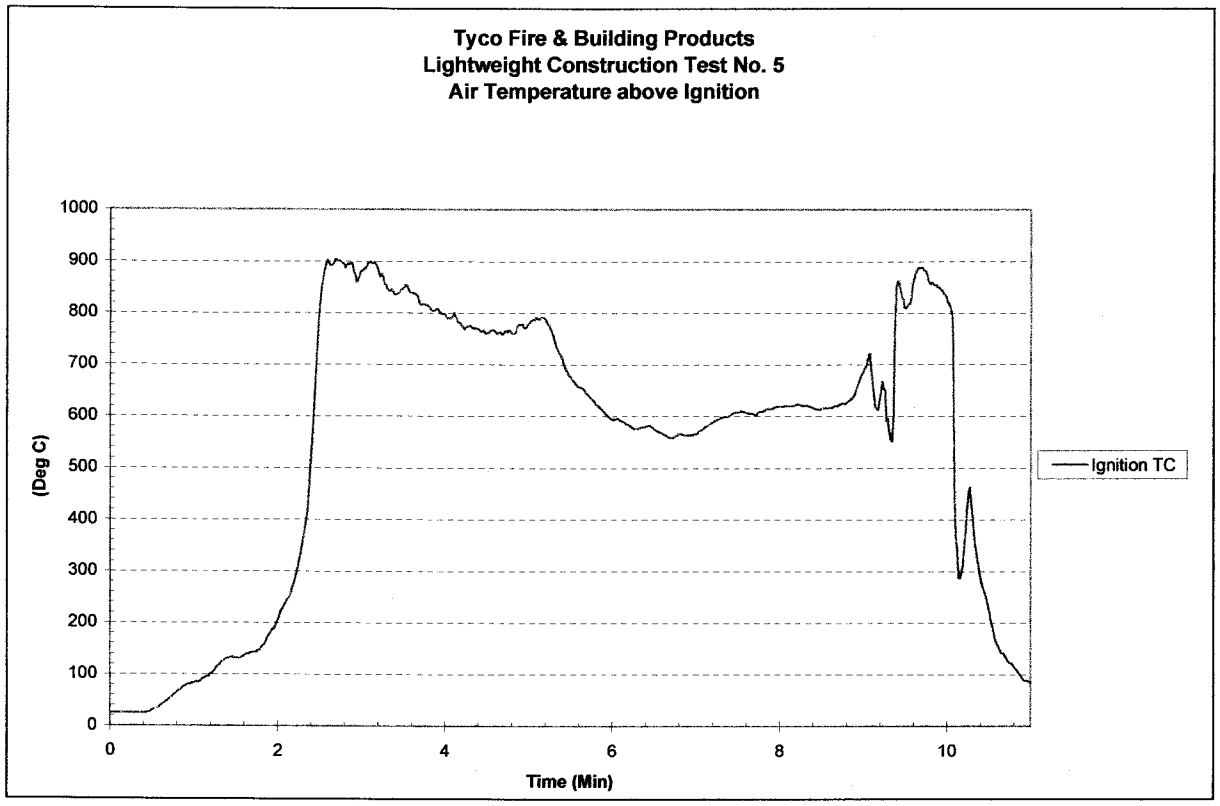
Test 4 FTIR Data

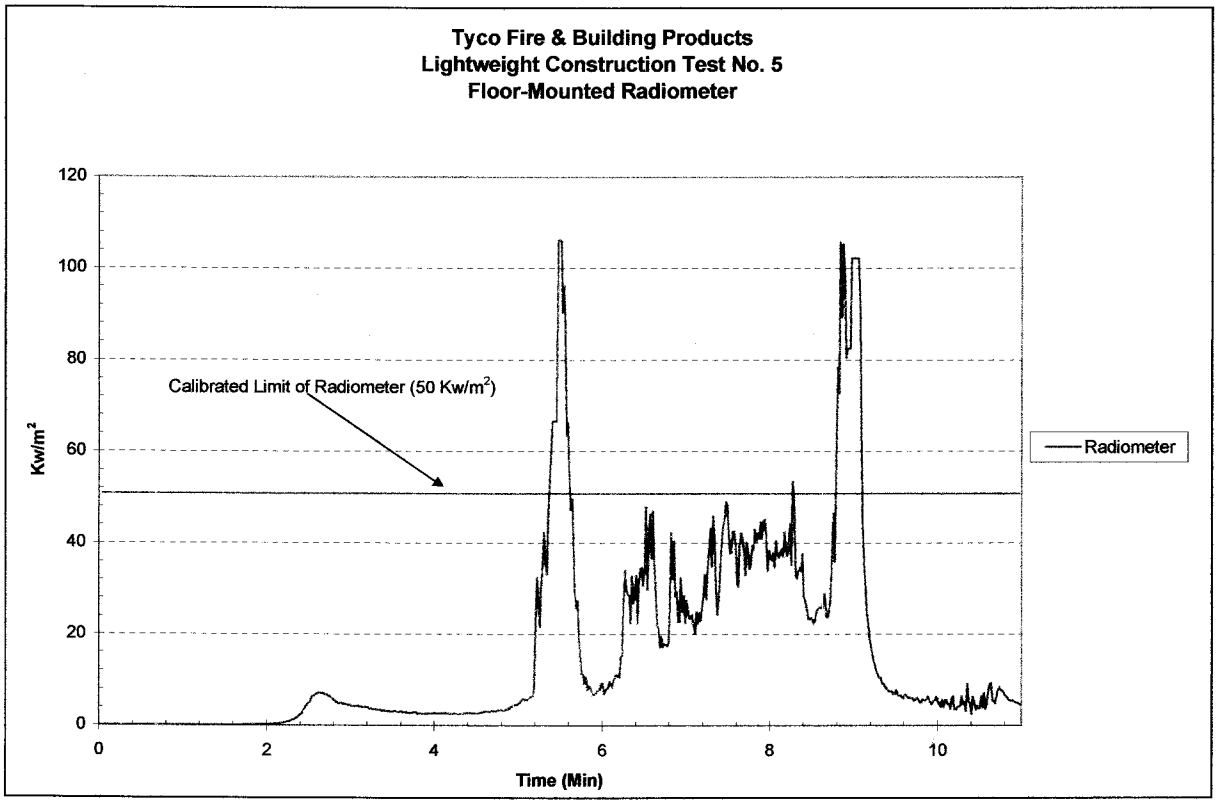
Test 4 First Unsprinklered Test, Damage

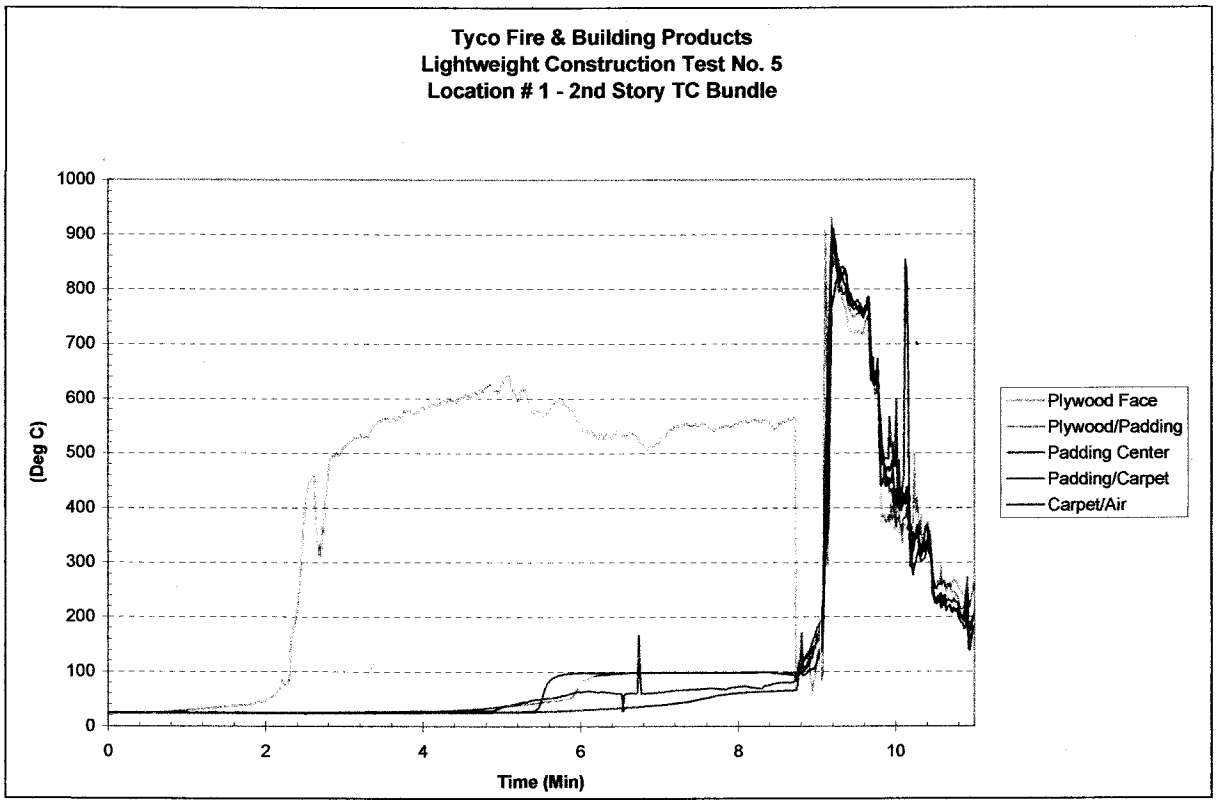
TEST 5: Second Unsprinklered "Freeburn" Test

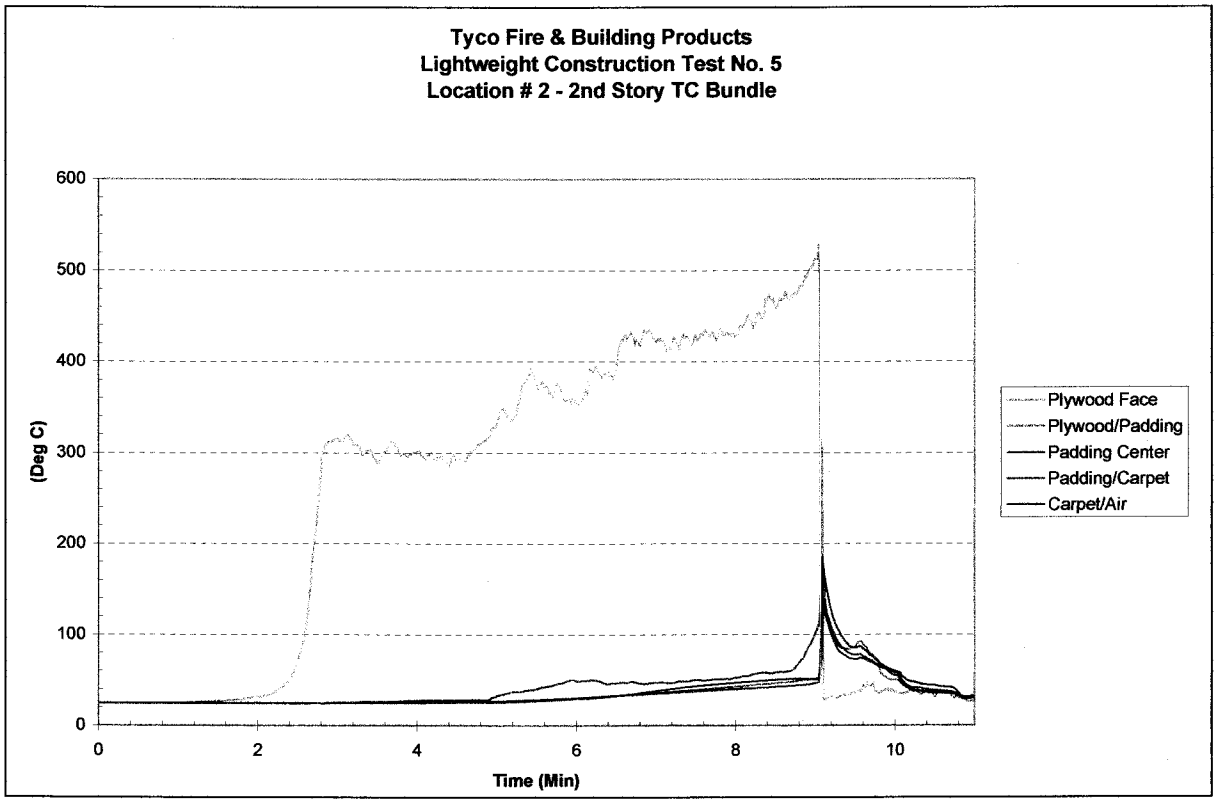
- August 8, 2008 at Underwriters Laboratories, Northbrook, IL
- Exposed Joists
- No sprinkler protection
- Room brought until collapse
- Flashover occurred at 5:15 from ignition
- Collapse occurred at approximately 8:34 from ignition
- Excessive damage, roof collapse
- Out of the 88 thermocouples added, only those thermocouples located in the ceiling/floor assembly are shown in the graphs below




Tyco Fire & Building Products
Lightweight Construction Test No. 5
Air Temperature above Ignition
(Deg C)
1000
900
800
700
600
500
400
300
200
100
0
0
2
4
6
8
10
Time (Min)
Ignition TC


Tyco Fire & Building Products
Lightweight Construction Test No. 5
Floor-Mounted Radiometer
Kw/m2
120
100
80
60
40
20
0
Calibrated Limit of Radiometer (50 Kw/m2)
0
2
4
6
8
10
Time (Min)
Radiometer


Tyco Fire & Building Products
Lightweight Construction Test No. 5
Location # 1 - 2nd Story TC Bundle
(Deg C)
1000
900
800
700
600
500
400
300
200
100
0
0
2
4
6
8
10
Time (Min)
Plywood Face
Plywood/Padding
Padding Center
Padding/Carpet
Carpet/Air


Tyco Fire & Building Products
Lightweight Construction Test No. 5
Location # 2 - 2nd Story TC Bundle
(Deg C)
600
500
400
300
200
100
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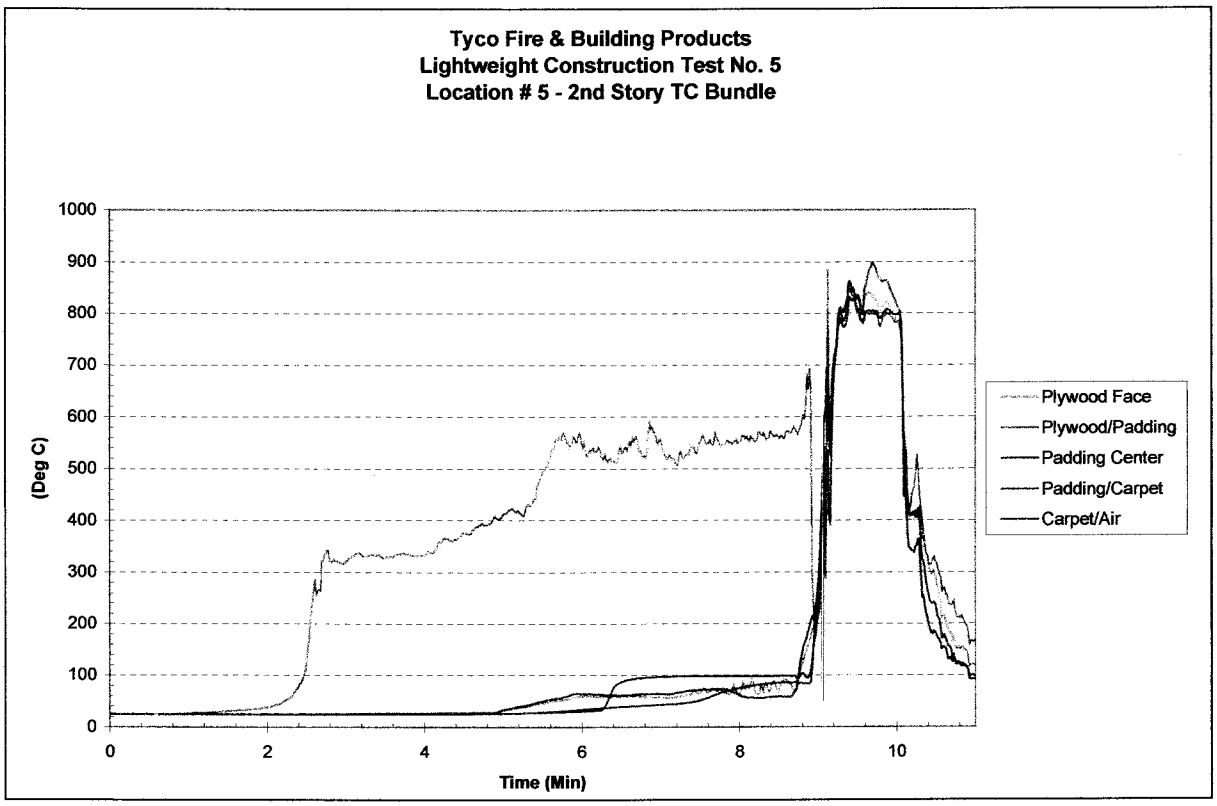
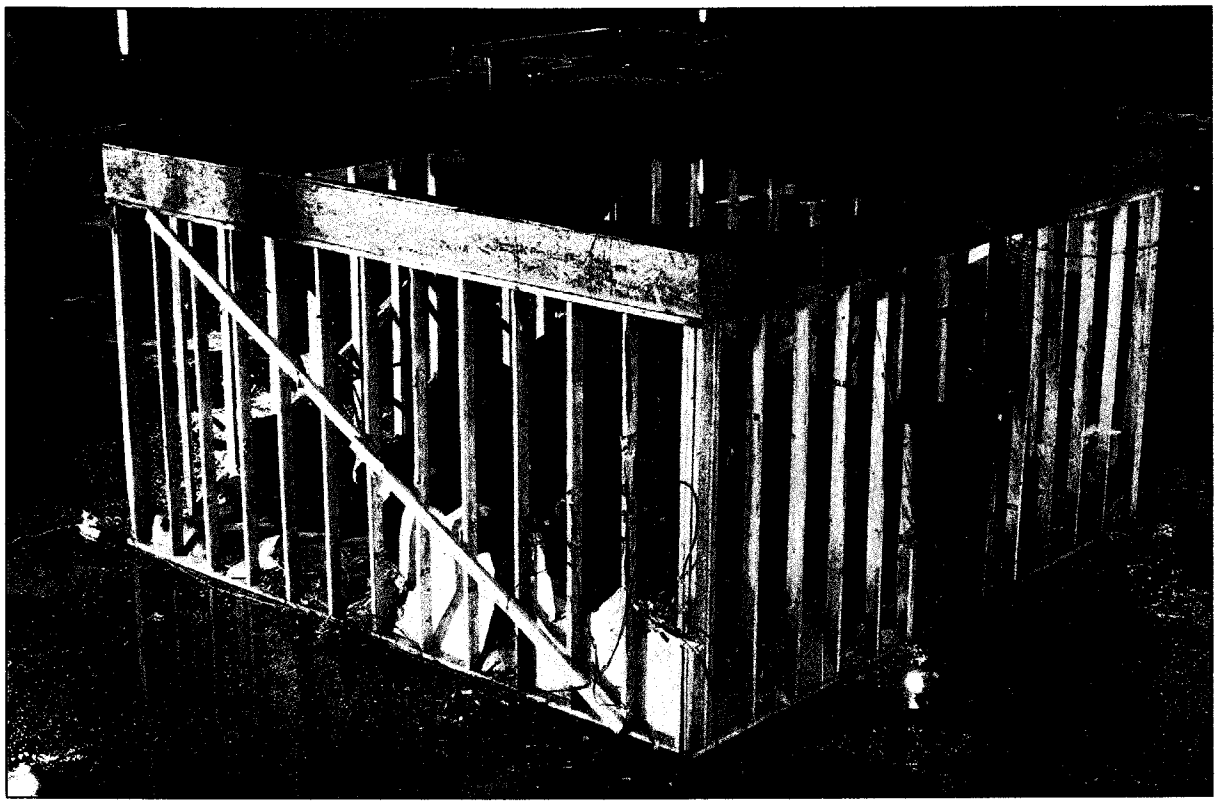
2
4
6
8
10
Time (Min)
Plywood Face
Plywood/Padding
Padding Center
Padding/Carpet
Carpet/Air





Test 5 second freeburn, damage

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rapid response™
HOME FIRE SPRINKLER SYSTEM

Series LFII Residential Horizontal Sidewall Sprinklers 4.2 K-factor

General Description

The Series LFII (TY1334) Residential Horizontal Sidewall Sprinklers are decorative, fast response, frangible bulb sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels. When aesthetics and optimized flow characteristics are the major consideration, the Series LFII (TY1334) should be the first choice.

The Series LFII are to be used in wet pipe residential sprinkler systems for one- and two-family dwellings and mobile homes per NFPA 13D; wet pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R; or, wet pipe sprinkler systems for the residential portions of any occupancy per NFPA 13.

The Series LFII (TY1334) has a 4.2 (60,5) K-factor that provides the required residential flow rates at reduced pressures, enabling smaller pipe sizes and water supply requirements.

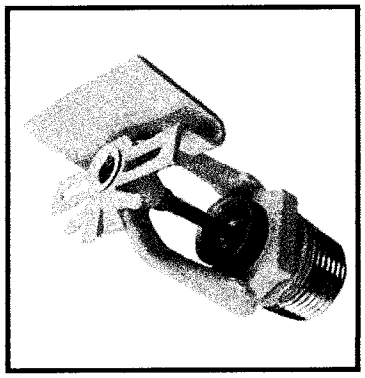
The recessed version of the Series LFII (TY1334) is intended for use in areas with finished walls. It employs a two-piece Style 20 Recessed Escutcheon. The Recessed Escutcheon provides 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush mounting surface position. The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the pipe nipples to the sprinklers must be cut.

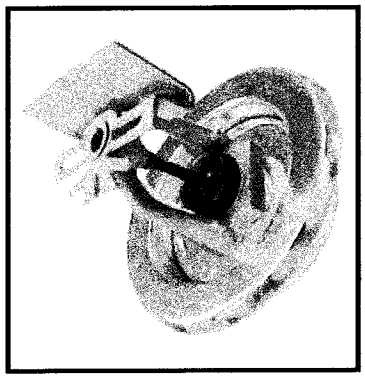
The Series LFII (TY1334) has been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.

IMPORTANT
Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

WARNINGS
The Series LFII (TY1334) Residential Horizontal Sidewall Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.





Sprinkler/Model Identification Number

SIN TY1334

Components:

1 - Frame
2 - Button Assembly
3 - Sealing Assembly
4 - Bulb
5 - Compression Screw
6 - Deflector *

* Temperature rating is indicated on top of Deflector.

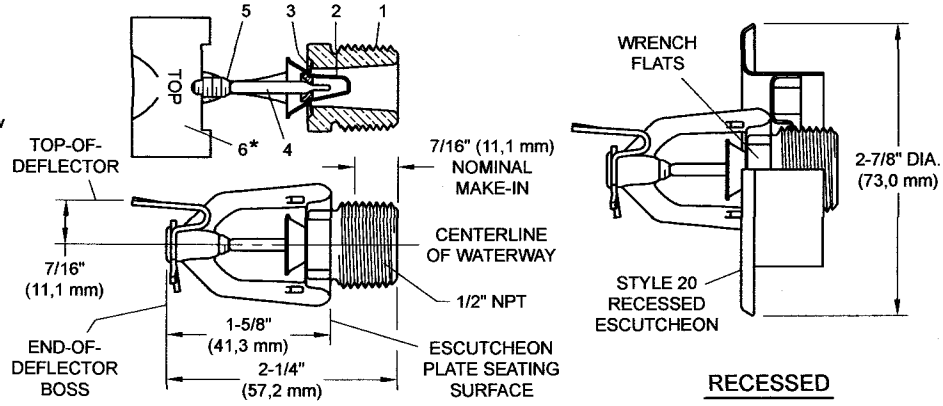


FIGURE 1
SERIES LFII (TY1334) RESIDENTIAL
HORIZONTAL SIDEWALL AND RECESSED HORIZONTAL SIDEWALL SPRINKLERS

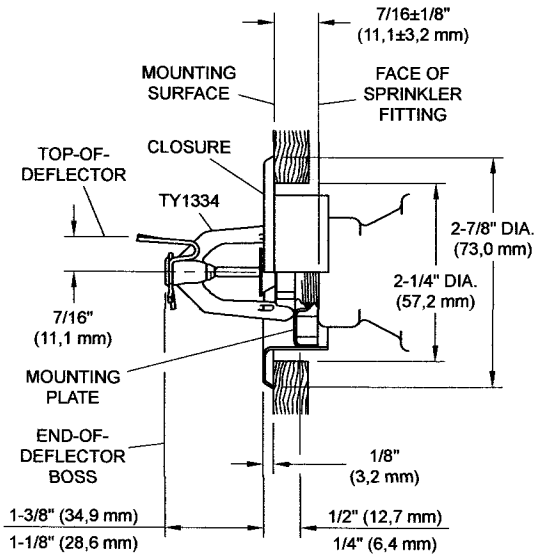


FIGURE 2
STYLE 20 RECESSED ESCUTCHEON
FOR USE WITH THE SERIES LFII (TY1334)
RESIDENTIAL HORIZONTAL SIDEWALL SPRINKLER

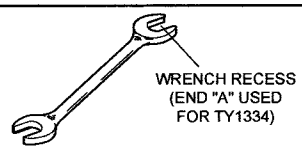


FIGURE 3
W-TYPE 6 SPRINKLER WRENCH

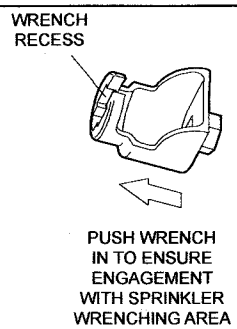


FIGURE 4
W-TYPE 7 RECESSED
SPRINKLER WRENCH

Technical Data

Approvals:
UL and C-UL Listed. NYC Approved under MEA 44-03-E.

Maximum Working Pressure:
175 psi (12,1 bar)

Discharge Coefficient:
K = 4.2 GPM/psi$^{1/2}$ (60,5 LPM/bar$^{1/2}$)

Temperature Rating:
155°F/68°C or 175°F/79°C

Finishes:
White Polyester Coated,
Chrome Plated, or Natural Brass

Physical Characteristics:

Frame	Brass
Button	Bronze
Sealing Assembly	Beryllium Nickel w/Teflon†
Bulb	3 mm dia. Glass
Compression Screw	Bronze
Deflector	Copper

†Dupont Registered Trademark

Operation

The glass Bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass Bulb allowing the sprinkler to activate and flow water.

Design Criteria

The Series LFII (TY1334) Residential Horizontal Sidewall Sprinklers are UL and C-UL Listed for installation in accordance with the following criteria.

NOTE
When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the local Authority Having Jurisdiction.

System Type. Only wet pipe systems may be utilized.

Hydraulic Design. The minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R are given in Table A, B, C, and D as a function of temperature rating and the maximum allowable coverage areas. The sprinkler flow rate is the minimum required discharge from each of the total number of "design sprinklers" as specified in NFPA 13D or NFPA 13R.

For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Tables A, B, C, and D for NFPA 13D and 13R as a function of temperature rating and the maximum allowable coverage area.
- A minimum discharge of 0.1 gpm/sq. ft. over the "design area" comprised of the four most hydraulically demanding sprinklers for the actual coverage areas being protected by the four sprinklers.

Obstruction To Water Distribution. Locations of sprinklers are to be in accordance with the obstruction rules of NFPA 13 for residential sprinklers.

Operational Sensitivity. The sprinklers are to be installed with an end-of-deflector-boss to wall distance of 1-3/8 to 6 inches or in the recessed position using only the Style 20 Recessed Escutcheon as shown in Figure 2.

In addition the top-of-deflector-to-ceiling distance is to be within the range (Ref. Table A, B, C, or D) being hydraulically calculated.

Sprinkler Spacing. The minimum spacing between sprinklers is 8 feet (2,4 m). The maximum spacing between sprinklers cannot exceed the width of the coverage area (Ref. Table A) being hydraulically calculated (e.g., maximum 12 feet for a 12 ft. x 12 ft. coverage area, or 16 feet for a 16 ft. x 20 ft. coverage area).

Installation

The Series LFII (TY1334) must be installed in accordance with the following instructions:

NOTES
Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm).

A leak tight 1/2 inch NPT sprinkler joint should be obtained with a torque of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). A maximum of 21 ft.lbs. (28,5 Nm) of torque is to be used to install sprinklers. Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in an Escutcheon Plate by under- or over-tightening the Sprinkler. Readjust the position of the sprinkler fitting to suit.

The Series LFII Horizontal Sidewall Sprinklers must be installed in accordance with the following instructions.

Step 1. Horizontal sidewall sprinklers are to be installed in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. The word "TOP" on the Deflector is to face towards the ceiling with the front edge of the Deflector parallel to the ceiling.

Step 2. With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step 3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Ref. Figure 3). With reference to Figure 1, the W-Type 6 Sprinkler Wrench is to be applied to the wrench flats.

The **Series LFII Recessed Horizontal Sidewall Sprinklers** must be installed in accordance with the following instructions.

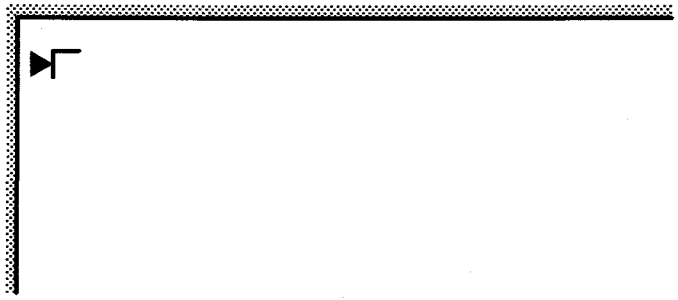
Step A. Recessed horizontal sidewall sprinklers are to be installed in the horizontal position with their centerline of waterway perpendicular to the back wall and parallel to the ceiling. The word "TOP" on the Deflector is to face towards the ceiling.

Step B. After installing the Style 20 Mounting Plate over the sprinkler threads and with pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step C. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Ref. Figure 4). With reference to Figure 1, the W-Type 7 Recessed Sprinkler Wrench is to be applied to the sprinkler wrench flats.

Step C. After the wall has been installed or the finish coat has been applied, slide on the Style 20 Closure over the Series LFII Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the wall.

(Continued on Page 8)



ELEVATION

Maximum Coverage Area [a] Width x Length [b] Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow [c] and Residual Pressure			
		Top-Of-Deflector- To- Ceiling: 4 to 6 Inches (100 to 150 mm)		Top-Of-Deflector- To- Ceiling: 6 to 12 Inches (150 to 300 mm)	
		155°F/68°C	175°F/79°C	155°F/68°C	175°F/79°C
12 x 12 (3,7 x 3,7)	12 (3,7)	12 GPM (45,4 LPM) 8.2 psi (0,57 bar)	12 GPM (45,4 LPM) 8.2 psi (0,57 bar)	13 GPM (49,2 LPM) 9.6 psi (0,66 bar)	13 GPM (49,2 LPM) 9.6 psi (0,66 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	14 GPM (53,0 LPM) 11.1 psi (0,77 bar)	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	17 GPM (64,3 LPM) 16.4 psi (1,13 bar)	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)
16 x 18 (4,9 x 5,5)	16 (4,9)	19 GPM (71,9 LPM) 20.5 psi (1,41 bar)	19 GPM (71,9 LPM) 20.5 psi (1,41 bar)	21 GPM (79,5 LPM) 25.0 psi (1,72 bar)	21 GPM (79,5 LPM) 25.0 psi (1,72 bar)
16 x 20 (4,9 x 6,1)	16 (4,9)	23 GPM (87,1 LPM) 30.0 psi (2,07 bar)	23 GPM (87,1 LPM) 30.0 psi (2,07 bar)	26 GPM (98,4 LPM) 38.3 psi (2,64 bar)	26 GPM (98,4 LPM) 38.3 psi (2,64 bar)

(a) *For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next* highest coverage area for which hydraulic design criteria are stated.

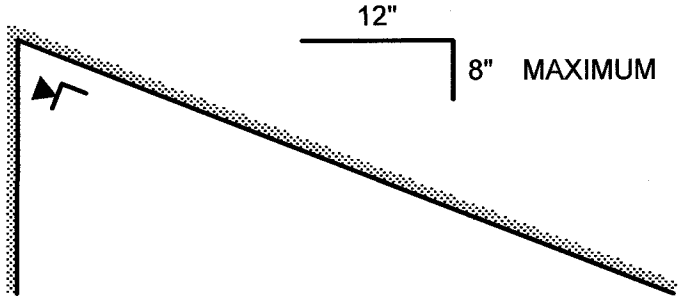
(b) Width (backwall where sprinkler is located) x Length (horizontal throw of sprinkler).

(c) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details.

(d) Sidewall sprinklers, where installed under a ceiling with a slope greater than 0 inch rise for a 12 inch run to a slope up to 2 inch rise for 12 inch run, must be located per one of the following:

- Locate the sprinklers at the high point of the slope and positioned to discharge down the slope.
- Locate the sprinklers along the slope and positioned to discharge across the slope.

TABLE A
NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA
FOR THE SERIES LFII (TY1334)
RESIDENTIAL HORIZONTAL SIDEWALL AND RECESSED HORIZONTAL SIDEWALL SPRINKLERS
FOR HORIZONTAL CEILING (Maximum 2 Inch Rise for 12 Inch Run)



ELEVATION

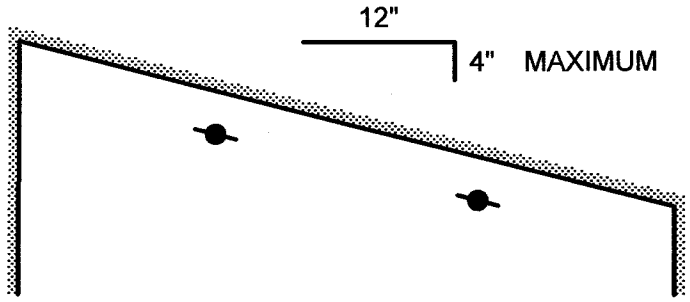
Maximum Coverage Area [a] Width x Length [b] Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow [c] and Residual Pressure (I) Two sprinkler design with the sprinklers at the high point of the slope and positioned to discharge down the slope.							
		Top-Of-Deflector- To- Ceiling: 4 to 6 Inches (100 to 150 mm)				Top-Of-Deflector- To- Ceiling: 6 to 12 Inches (150 to 300 mm)			
		155°F/68°C		175°F/79°C		155°F/68°C		175°F/79°C	
12 x 12 (3,7 x 3,7)	12 (3,7)	I	12 GPM (45,4 LPM) 8.2 psi (0,57 bar)	I	12 GPM (45,4 LPM) 8.2 psi (0,57 bar)	I	13 GPM (49,2 LPM) 9.6 psi (0,66 bar)	I	13 GPM (49,2 LPM) 9.6 psi (0,66 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	I	14 GPM (53,0 LPM) 11.1 psi (0,77 bar)	I	14 GPM (53,0 LPM) 11.1 psi (0,77 bar)	I	17 GPM (64.3 LPM) 16.4 psi (1,13 bar)	I	17 GPM (64.3 LPM) 16.4 psi (1,13 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	I	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	I	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	I	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)	I	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)
16 x 18 (4,9 x 5,5)	16 (4,9)	I	19 GPM (71,9 LPM) 20.5 psi (1,41 bar)	I	19 GPM (71,9 LPM) 20.5 psi (1,41 bar)	I	21 GPM (79,5 LPM) 25.0 psi (1,72 bar)	I	21 GPM (79,5 LPM) 25.0 psi (1,72 bar)
16 x 20 (4,9 x 6,1)	16 (4,9)	I	24 GPM (90,8 LPM) 32.7 psi (2,25 bar)	I	24 GPM (90,8 LPM) 32.7 psi (2,25 bar)	I	26 GPM (98,4 LPM) 38.3 psi (2,64 bar)	I	26 GPM (98,4 LPM) 38.3 psi (2,64 bar)

(a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

(b) Width (backwall where sprinkler is located) x Length (horizontal throw of sprinkler).

(c) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details..

TABLE B
NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA
FOR THE SERIES LFII (TY1334)
RESIDENTIAL HORIZONTAL SIDEWALL AND RECESSED HORIZONTAL SIDEWALL SPRINKLERS
FOR SPRINKLERS AT THE HIGH POINT OF THE SLOPE AND DISCHARGING DOWN THE SLOPE
(Greater Than 2 Inch Rise for 12 Inch Run Up To 8 Inch Rise for 12 Inch Run)



ELEVATION

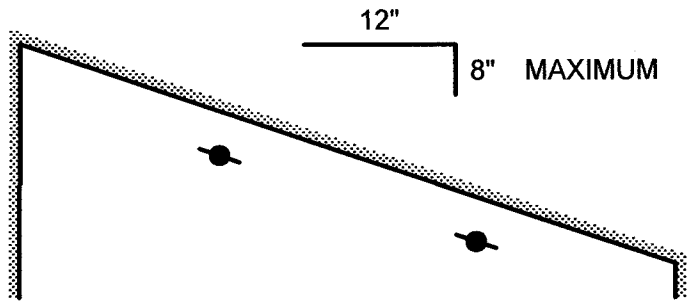
Maximum Coverage Area [a] Width x Length [b] Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow [c] and Residual Pressure (II) Two sprinkler design with the sprinklers located along the slope and positioned to discharge across the slope. (III) Three sprinkler design when there are more than two sprinklers in a compartment and with the sprinklers located along the slope and positioned to discharge across the slope.							
		Top-Of-Deflector- To- Ceiling: 4 to 6 Inches (100 to 150 mm)				Top-Of-Deflector- To- Ceiling: 6 to 12 Inches (150 to 300 mm)			
		155°F/68°C		175°F/79°C		155°F/68°C		175°F/79°C	
12 x 12 (3,7 x 3,7)	12 (3,7)	II	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	II	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	II	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)	II	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	II	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	II	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	II	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)	II	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	II	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	II	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	II	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)	II	18 GPM (68,1 LPM) 18.4 psi (1,27 bar)
16 x 18 (4,9 x 5,5)	16 (4,9)	II	22 GPM (83,3 LPM) 27.4 psi (1,89 bar)	II	22 GPM (83,3 LPM) 27.4 psi (1,89 bar)	II	22 GPM (83,3 LPM) 27.4 psi (1,89 bar)	II	22 GPM (83,3 LPM) 27.4 psi (1,89 bar)
16 x 20 (4,9 x 6,1)	16 (4,9)	III	23 GPM (87,1 LPM) 30.0 psi (2,07 bar)	III	23 GPM (87,1 LPM) 30.0 psi (2,07 bar)	III	26 GPM (98,4 LPM) 38.3 psi (2,64 bar)	III	26 GPM (98,4 LPM) 38.3 psi (2,64 bar)

(a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

(b) Width (backwall where sprinkler is located) x Length (horizontal throw of sprinkler).

(c) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details..

TABLE C
NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA
FOR THE SERIES LFII (TY1334)
RESIDENTIAL HORIZONTAL SIDEWALL AND RECESSED HORIZONTAL SIDEWALL SPRINKLERS
FOR SPRINKLERS LOCATED ALONG A SLOPE AND DISCHARGING ACROSS THE SLOPE
(Greater Than 2 Inch Rise for 12 Inch Run Up To 4 Inch Rise for 12 Inch Run)



ELEVATION

Maximum Coverage Area [a] Width x Length [b] Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow [c] and Residual Pressure (III) Three sprinkler design when there are more than two sprinklers in a compartment and with the sprinklers located along the slope and positioned to discharge across the slope.			
		Top-Of-Deflector- To- Ceiling: 4 to 6 Inches (100 to 150 mm)			
		155°F/68°C		175°F/79°C	
12 x 12 (3,7 x 3,7)	12 (3,7)	III	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	III	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	III	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	III	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	III	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)	III	16 GPM (60,6 LPM) 14.5 psi (1,00 bar)
16 x 18 (4,9 x 5,5)	16 (4,9)	N/A		N/A	
16 x 20 (4,9 x 6,1)	16 (4,9)	N/A		N/A	

(a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

(b) Width (backwall where sprinkler is located) x Length (horizontal throw of sprinkler).

(c) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details..

TABLE D
NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA
FOR THE SERIES LFII (TY1334)
RESIDENTIAL HORIZONTAL SIDEWALL AND RECESSED HORIZONTAL SIDEWALL SPRINKLERS
FOR SPRINKLERS LOCATED ALONG A SLOPE AND DISCHARGING ACROSS THE SLOPE
(Greater Than 4 Inch Rise for 12 Inch Run Up To 8 Inch Rise for 12 Inch Run)

Care and Maintenance

The Series LFII (TY1334) must be maintained and serviced in accordance with the following instructions:

NOTES

Absence of an Escutcheon Plate may delay the sprinkler operation in a fire situation.

Before closing a fire protection system main control valve for maintenance work on the fire protection system which it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid damage to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

NOTE

The owner must assure that the sprinklers are not used for hanging of any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for *and properly installed and maintained* under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation. corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

When placing an order, indicate the full product name. Contact your local distributor for availability..

Sprinkler Assembly:

Series LFII (TY1334), K=4.2, Residential Horizontal Sidewall Sprinkler with (specify) temperature rating and (specify) finish, P/N (specify).

155°F/68°C or Chrome Plated	P/N 51-211-9-155
155°F/68°C White Polyester	P/N 51-211-4-155
155°F/68°C White (RAL9010)*	P/N 51-211-3-155
155°F/68°C Natural Brass	P/N 51-211-1-155
175°F/79°C or Chrome Plated	P/N 51-211-9-175
175°F/79°C White Polyester	P/N 51-211-4-175
175°F/79°C White (RAL9010)*	P/N 51-211-3-175
175°F/79°C Natural Brass	P/N 51-211-1-175

*Eastern Hemisphere sales only.

Recessed Escutcheon:

Specify: Style 20 Recessed Escutcheon with (specify*) finish, P/N (specify*).

*Refer to Technical Data Sheet TFP770.

Sprinkler Wrench:

Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001.

TYCO FIRE & BUILDING PRODUCTS, 451 North Cannon Avenue, Lansdale, Pennsylvania 19446

tyco / Fire & Building Products

Technical Services: Tel: (800) 381-9312 / Fax: (800) 791-5500

rapidresponse™
HOME FIRE SPRINKLER SYSTEM

Series LFII Residential Pendent Sprinklers 4.9 K-factor

General Description

The Series LFII (TY2234) Residential Pendent Sprinklers are decorative, fast response, frangible bulb sprinklers designed for use in residential occupancies such as homes, apartments, dormitories, and hotels. When aesthetics and optimized flow characteristics are the major consideration, the Series LFII (TY2234) should be the first choice.

The Series LFII are to be used in wet pipe residential sprinkler systems for one- and two-family dwellings and mobile homes per NFPA 13D; wet pipe residential sprinkler systems for residential occupancies up to and including four stories in height per NFPA 13R; or, wet pipe sprinkler systems for the residential portions of any occupancy per NFPA 13.

The Series LFII (TY2234) has a 4.9 (70,6) K-factor that provides the required residential flow rates at reduced pressures, enabling smaller pipe sizes and water supply requirements.

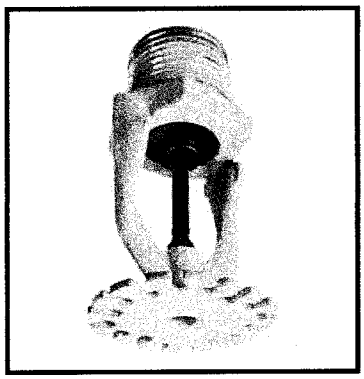
The recessed version of the Series LFII (TY2234) is intended for use in areas with finished ceilings. It employs a two-piece Style 20 Recessed Escutcheon. The Recessed Escutcheon provides 1/4 inch (6,4 mm) of recessed adjustment or up to 1/2 inch (12,7 mm) of total adjustment from the flush ceiling position. The adjustment provided by the Recessed Escutcheon reduces the accuracy to which the pipe nipples to the sprinklers must be cut.

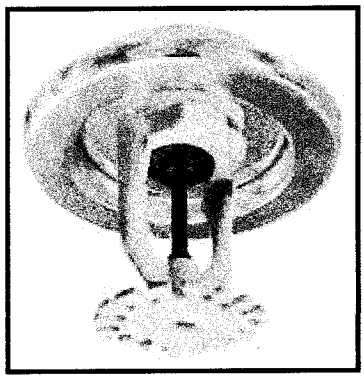
The Series LFII (TY2234) has been designed with heat sensitivity and water distribution characteristics proven to help in the control of residential fires and to improve the chance for occupants to escape or be evacuated.

IMPORTANT
Always refer to Technical Data Sheet TFP700 for the "INSTALLER WARNING" that provides cautions with respect to handling and installation of sprinkler systems and components. Improper handling and installation can permanently damage a sprinkler system or its components and cause the sprinkler to fail to operate in a fire situation or cause it to operate prematurely.

WARNINGS
The Series LFII (TY2234) Residential Pendent Sprinklers described herein must be installed and maintained in compliance with this document, as well as with the applicable standards of the National Fire Protection Association, in addition to the standards of any other authorities having jurisdiction. ***Failure to do so may impair the performance of these devices.***

The owner is responsible for maintaining their fire protection system and devices in proper operating condition. The installing contractor or sprinkler manufacturer should be contacted with any questions.





Sprinkler/Model Identification Number

SIN TY2234

Maximum Coverage Area [a] Ft. x Ft. (m x m)	Maximum Spacing Ft. (m)	Minimum Flow [b] and Residual Pressure For Horizontal Ceiling (Max. 2 Inch Rise for 12 Inch Run)	Minimum Flow [b] and Residual Pressure For Sloped Ceiling (Greater Than 2 Inch Rise Up To Max. 4 Inch Rise for 12 Inch Run)		Minimum Flow [b] and Residual Pressure For Sloped Ceiling (Greater Than 4 Inch Rise Up To Max. 8 Inch Rise for 12 Inch Run)	
		155°F/68°C or 175°F/79°C	155°F/68°C	175°F/79°C	155°F/68°C	175°F/79°C
12 x 12 (3,7 x 3,7)	12 (3,7)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
14 x 14 (4,3 x 4,3)	14 (4,3)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
16 x 16 (4,9 x 4,9)	16 (4,9)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	13 GPM (49,2 LPM) 7.0 psi (0,48 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
18 x 18 (5,5 x 5,5)	18 (5,5)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)	17 GPM (64,3 LPM) 12.0 psi (0,83 bar)
20 x 20 (6,1 x 6,1)	20 (6,1)	20 GPM (75,7 LPM) 16.7 psi (1,15 bar)	20 GPM (75,7 LPM) 16.7 psi (1,15 bar)	20 GPM (75,7 LPM) 16.7 psi (1,15 bar)	21 GPM (79,5 LPM) 18.4 psi (1,27 bar)	22 GPM (83,3 LPM) 20.2 psi (1,39 bar)

(a) For coverage area dimensions less than or between those indicated, it is necessary to use the minimum required flow for the next highest coverage area for which hydraulic design criteria are stated.

(b) Requirement is based on minimum flow in GPM (LPM) from each sprinkler. The associated residual pressures are calculated using the nominal K-factor. Refer to Hydraulic Design Criteria Section for details.

TABLE A
NFPA 13D AND NFPA 13R WET PIPE HYDRAULIC DESIGN CRITERIA FOR THE SERIES LFII (TY2234) RESIDENTIAL PENDENT AND RECESSED PENDENT SPRINKLERS

Technical Data

Approvals:
UL and C-UL Listed. NYC Approved under MEA 44-03-E.

Maximum Working Pressure:
175 psi (12,1 bar)

Discharge Coefficient:
K = 4.9 GPM/psi$^{1/2}$ (70,6 LPM/bar$^{1/2}$)

Temperature Rating:
155°F/68°C or 175°F/79°C

Finishes:
White Polyester Coated,
Chrome Plated, or Natural Brass

Physical Characteristics:
Frame . . . . . Brass
Button . . . . . Bronze
Sealing Assembly . . . . . Beryllium Nickel w/Teflon†
Bulb . . . . . 3 mm dia. Glass
Compression Screw . . . . . Bronze
Deflector . . . . . Bronze
Ejection Spring . . . . Stainless Steel
†DuPont Registered Trademark

Operation

The glass Bulb contains a fluid that expands when exposed to heat. When the rated temperature is reached, the fluid expands sufficiently to shatter the glass Bulb allowing the sprinkler to activate and flow water.

Design Criteria

The Series LFII (TY2234) Residential Pendent Sprinklers are UL and C-UL Listed for installation in accordance with the following criteria.

NOTE
When conditions exist that are outside the scope of the provided criteria, refer to the Residential Sprinkler Design Guide TFP490 for the manufacturer's recommendations that may be acceptable to the local Authority having Jurisdiction.

System Type. Only wet pipe systems may be utilized.

Hydraulic Design. The minimum required sprinkler flow rate for systems designed to NFPA 13D or NFPA 13R are given in Table A as a function of temperature rating and the maximum allowable coverage areas. The sprinkler flow rate is the minimum required discharge from each of the total number of "design sprinklers" as specified in NFPA 13D or NFPA 13R.

For systems designed to NFPA 13, the number of design sprinklers is to be the four most hydraulically demanding sprinklers. The minimum required discharge from each of the four sprinklers is to be the greater of the following:

- The flow rates given in Table A for NFPA 13D and 13R as a function of temperature rating and the maximum allowable coverage area.
- A minimum discharge of 0.1 gpm/sq. ft. over the "design area" comprised of the four most hydraulically demanding sprinklers for the actual coverage areas being protected by the four sprinklers.

Obstruction To Water Distribution. Locations of sprinklers are to be in accordance with the obstruction rules of NFPA 13 for residential sprinklers.

Operational Sensitivity.

- For "Horizontal Ceilings" (maximum 2 inch rise for 12 inch run), the sprinklers are to be installed with a deflector to ceiling distance of 1-3/8 to 4 inches or in the recessed position using only the Style 20 Recessed Escutcheon as shown in Figure 2.

NOTES
The "Beam Ceiling Design Criteria" section starting on Page 4 permits deflector to ceiling distances up to 15-3/4 inches.

So as to help avoid obstructions to water distribution, a maximum 12 inch deflector-to-ceiling distance is permitted for NFPA 13D and NFPA 13R applications where the sprinklers are located in closets.

- For "Sloped Ceilings" (greater than 2 inch rise up to 8 inch rise for 12 inch run), the sprinklers are to be installed with a deflector to ceiling

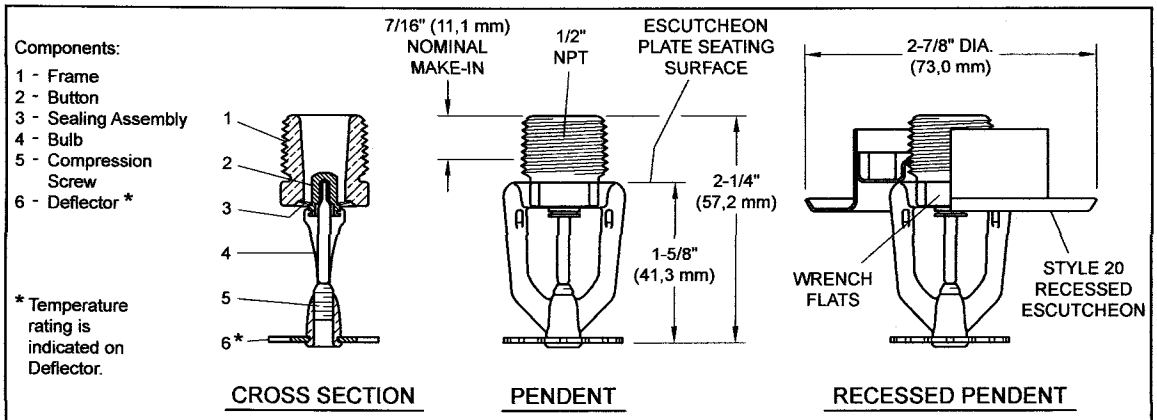


FIGURE 1
SERIES LFII (TY2234) RESIDENTIAL
PENDENT AND RECESSED PENDENT SPRINKLERS

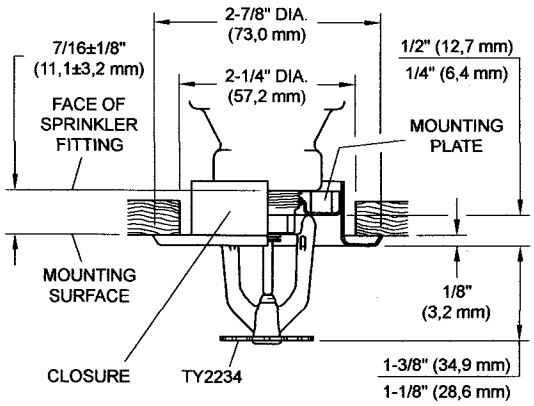
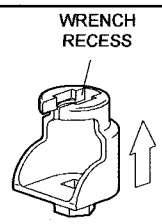


FIGURE 2
STYLE 20 RECESSED ESCUTCHEON
FOR USE WITH THE SERIES LFII (TY2234)
RESIDENTIAL PENDENT SPRINKLER

FIGURE 3
W-TYPE 6
SPRINKLER WRENCH



PUSH WRENCH IN TO ENSURE ENGAGEMENT WITH SPRINKLER WRENCHING AREA

FIGURE 4
W-TYPE 7 RECESSED
SPRINKLER WRENCH

distance of 1-3/8 to 4 inches or in the recessed position using only the Style 20 Recessed Escutcheon as shown in Figure 2

Sprinkler Spacing. The minimum spacing between sprinklers is 8 feet (2,4 m). The maximum spacing between sprinklers cannot exceed the length of the coverage area (Ref. Table A) being hydraulically calculated (e.g., maximum 12 feet for a 12 ft. x 12 ft. coverage area, or 20 feet for a 20 ft. x 20 ft. coverage area).

Beam Ceiling Design Criteria

The Series LFII (TY2234) Residential Pendent Sprinklers are UL and C-UL Listed for installation in residential occupancies with horizontal ceilings (i.e., slopes up to a 2 inch rise over a 12 inch run) with beams when installed in accordance with the following criteria:

General Information. The basic concept of this protection scheme is to locate the sprinklers on the underside of the beams, Ref. Figure 5, (not in the beam pockets); to identify the main beams that principally run in one direction as "primary beams"; and, to identify the beams that run principally perpendicular to the main beams, as may be present (or in some cases may be necessary for proper sprinkler protection), as "secondary beams".

Primary and Secondary Beam Types. Solid surface, solid or hollow core, combustible or non-combustible.

Primary and Secondary Beam Positioning. Directly attached to the underside of a combustible or non-combustible smooth ceiling at any elevation.

Primary Beam Cross-Section: Maximum depth of 14 inches and the maximum width is unlimited. The cross-sectional shape of the primary beam may be rectangular to circular.

Secondary Beam Cross-Section. Maximum depth to be no greater than the primary beam and the maximum width is unlimited. The cross-sectional shape of the secondary beam may be rectangular to circular.

Primary Beam Spacing. The primary beams (Fig. 6A) are to be 3 ft. - 4 in. to 6 ft. from the compartment wall to center of the nearest beam and from center to center between beams.

Secondary Beam Spacing. The secondary beams principally run perpendicular to the primary beams.

Secondary beams of a depth equal to the primary beam must be placed so that the beam pockets created by the primary beams do not exceed 20 feet in length (Fig. 6B).

NOTE

When the beam pockets created by the primary beams exceed 20 feet in length, the installation will require the use of secondary beams as described above. Otherwise, secondary beams need not be present.

Secondary beams of a cross-sectional depth greater than one-quarter the depth of the primary beams are to be a minimum of 3 ft. - 4 in. from the compartment wall to center of the nearest beam and from center to center between beams (Fig. 6C).

Secondary beams of a cross-sectional depth no greater than one-quarter the depth of the primary beams may be placed at any compartment wall to center of the nearest beam distance and from any center to center distance between beams (Fig. 6C).

Lintels. Lintels over doorways exiting the compartment must be present. The minimum height for the lintels is 8 inches or no less than the depth of the Primary Beams, whichever is greater.

Sprinkler Types. Series LFII (TY2234), 155F and 175F, Pendent and Recessed Pendent Residential Sprinklers.

Sprinkler Coverage Area and Hydraulic Design. The sprinkler coverage areas and hydraulic design criteria as presented in the Table A for "Horizontal Ceilings" are to be applied.

Sprinkler Position. The deflector to bottom of primary beams for the Series LFII (TY2234) Pendent Sprinklers or Series LFII (TY2234) Recessed Pendent Sprinklers is to be 1-1/4 to 1-3/4 inches (Fig. 5A). The vertical centerline of the Series LFII (TY2234) Pendent Sprinklers is to be no greater than half the primary beam cross-sectional width plus 2 inches from the centerline of the primary beam (Fig 5B).

NOTES

Core drilling of beams to allow the installation of sprinkler drops requires consulting with a structural engineer.

Where core drilling is not permitted, the previously stated sprinkler position criteria for the Series LFII (TY2234) Pendent Sprinklers allows for the sprinkler drop to be placed adjacent to the primary beam.

Beam and Soffit Arrangements. A soffit is permitted to be placed around the perimeter of a compartment with the beam arrangement within the soffited area (Fig.7).

The cross-section of the soffit may be any size as long as it does not create an obstruction to water distribution per the obstruction rules of NFPA 13 for residential sprinklers.

When soffits are present, the previously provided 3 ft. - 4 in. to 6 ft. "compartment wall to adjacent beam" distance for the primary and secondary beams is to be measured from the face of the soffit as opposed to the compartment wall.

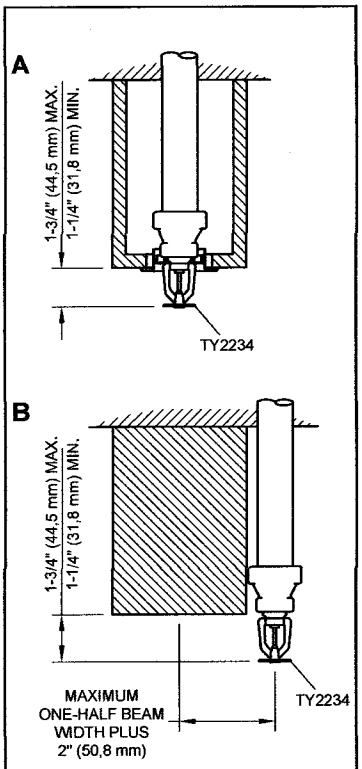


FIGURE 5
SPRINKLER POSITIONING UNDER PRIMARY BEAMS
(Refer to the "Beam Ceiling Design Criteria" section)

NOTE

Although the distance to the beams is measured from the face of the soffit, the sprinkler coverage area is to be measured from the compartment wall.

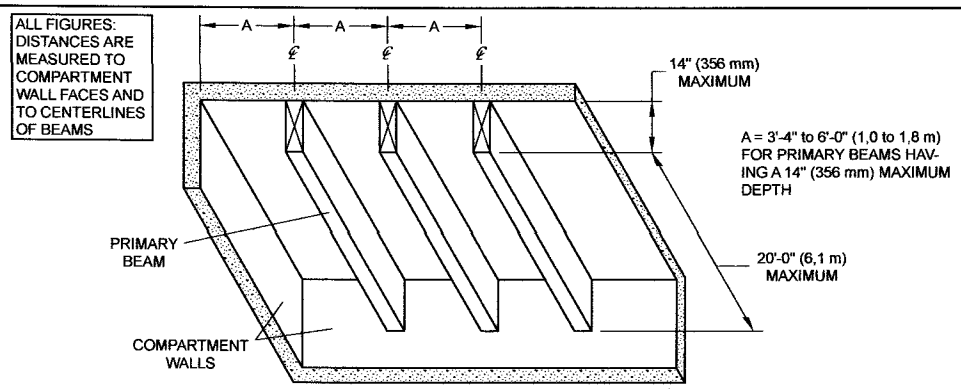


FIGURE 6A

PRIMARY BEAM SPANS UP TO 20'-0" (6,1 m)

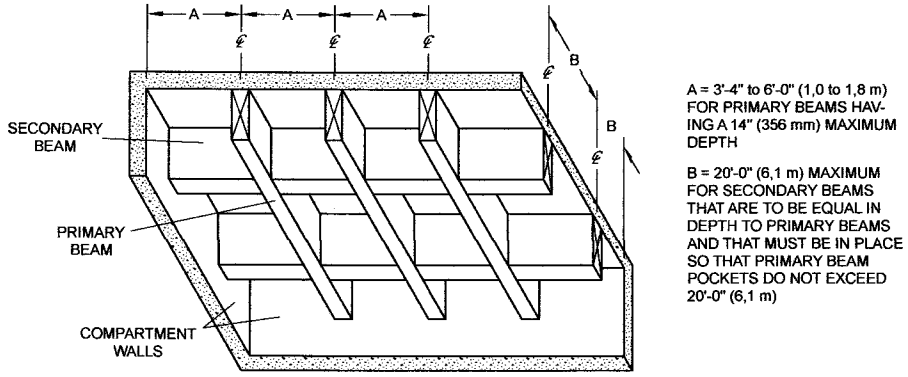


FIGURE 6B

PRIMARY BEAM SPANS GREATER THAN 20'-0" (6,1 m)

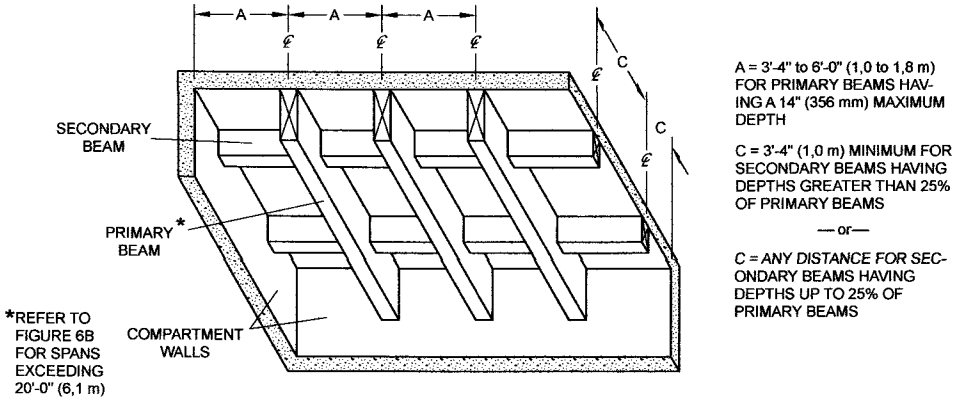


FIGURE 6C

COMBINATIONS OF PRIMARY AND SECONDARY BEAMS

FIGURE 6
BEAM ARRANGEMENTS
(Refer to the "Beam Ceiling Design Criteria" section)

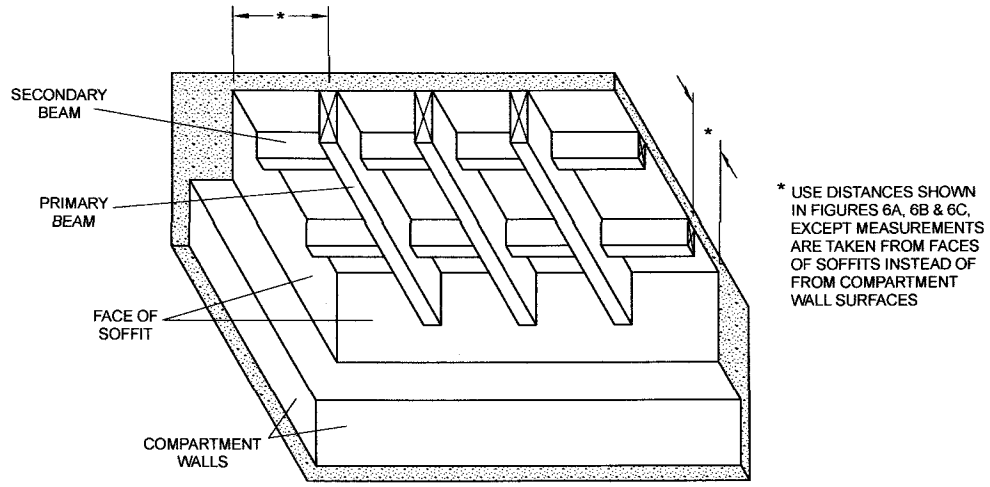


FIGURE 7
BEAM AND SOFFIT ARRANGEMENTS
(Refer to the "Beam Ceiling Design Criteria" section)

Installation

The Series LFII (TY2234) must be installed in accordance with the following instructions:

NOTES

Do not install any bulb type sprinkler if the bulb is cracked or there is a loss of liquid from the bulb. With the sprinkler held horizontally, a small air bubble should be present. The diameter of the air bubble is approximately 1/16 inch (1,6 mm).

A leak tight 1/2 inch NPT sprinkler joint should be obtained with a torque of 7 to 14 ft.lbs. (9,5 to 19,0 Nm). A maximum of 21 ft.lbs. (28,5 Nm) of torque is to be used to install sprinklers. Higher levels of torque may distort the sprinkler inlet with consequent leakage or impairment of the sprinkler.

Do not attempt to compensate for insufficient adjustment in an Escutcheon Plate by under- or over-tightening the Sprinkler. Readjust the position of the sprinkler fitting to suit.

The Series LFII Pendent Sprinklers must be installed in accordance with the following instructions.

Step 1. Pendent sprinklers are to be installed in the pendent position with the deflector parallel to the ceiling.

Step 2. With pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step 3. Tighten the sprinkler into the sprinkler fitting using only the W-Type 6 Sprinkler Wrench (Ref. Figure 3). With reference to Figure 1, the W-Type 6 Sprinkler Wrench is to be applied to the wrench flats.

The **Series LFII Recessed Pendent Sprinklers** must be installed in accordance with the following instructions.

Step A. Recessed pendent sprinklers are to be installed in the pendent position with the deflector parallel to the ceiling.

Step B. After installing the Style 20 Mounting Plate over the sprinkler threads and with pipe thread sealant applied to the pipe threads, hand tighten the sprinkler into the sprinkler fitting.

Step C. Tighten the sprinkler into the sprinkler fitting using only the W-Type 7 Recessed Sprinkler Wrench (Ref. Figure 4). With reference to Figure 1, the W-Type 7 Recessed Sprinkler Wrench is to be applied to the sprinkler wrench flats.

Step D. After the ceiling has been installed or the finish coat has been applied, slide on the Style 20 Closure over the Series LFII Sprinkler and push the Closure over the Mounting Plate until its flange comes in contact with the ceiling.

Care and Maintenance

The Series LFII (TY2234) must be maintained and serviced in accordance with the following instructions:

NOTES

Absence of an Escutcheon Plate may delay the sprinkler operation in a fire situation.

Before closing a fire protection system main control valve for maintenance work on the fire protection system which it controls, permission to shut down the affected fire protection system must be obtained from the proper authorities and all personnel who may be affected by this action must be notified.

Sprinklers which are found to be leaking or exhibiting visible signs of corrosion must be replaced.

Automatic sprinklers must never be painted, plated, coated, or otherwise altered after leaving the factory. Modified sprinklers must be replaced. Sprinklers that have been exposed to corrosive products of combustion, but have not operated, should be replaced if they cannot be completely cleaned by wiping the sprinkler with a cloth or by brushing it with a soft bristle brush.

Care must be exercised to avoid dam-

age to the sprinklers - before, during, and after installation. Sprinklers damaged by dropping, striking, wrench twist/slippage, or the like, must be replaced. Also, replace any sprinkler that has a cracked bulb or that has lost liquid from its bulb. (Ref. Installation Section).

The owner is responsible for the inspection, testing, and maintenance of their fire protection system and devices in compliance with this document, as well as with the applicable standards of the National Fire Protection Association (e.g., NFPA 25), in addition to the standards of any other authorities having jurisdiction. The installing contractor or sprinkler manufacturer should be contacted relative to any questions.

NOTE

The owner must assure that the sprinklers are not used for hanging of any objects and that the sprinklers are only cleaned by means of gently dusting with a feather duster; otherwise, non-operation in the event of a fire or inadvertent operation may result.

It is recommended that automatic sprinkler systems be inspected, tested, and maintained by a qualified Inspection Service in accordance with local requirements and/or national codes.

Limited Warranty

Products manufactured by Tyco Fire & Building Products (TFBP) are warranted solely to the original Buyer for ten (10) years against defects in material and workmanship when paid for *and properly installed and maintained* under normal use and service. This warranty will expire ten (10) years from date of shipment by TFBP. No warranty is given for products or components manufactured by companies not affiliated by ownership with TFBP or for products and components which have been subject to misuse, improper installation, corrosion, or which have not been installed, maintained, modified or repaired in accordance with applicable Standards of the National Fire Protection Association, and/or the standards of any other Authorities Having Jurisdiction. Materials found by TFBP to be defective shall be either repaired or replaced, at TFBP's sole option. TFBP neither assumes, nor authorizes any person to assume for it, any other obligation in connection with the sale of products or parts of products. TFBP shall not be responsible for sprinkler system design errors or inaccurate or incomplete information supplied by Buyer or Buyer's representatives.

In no event shall TFBP be liable, in contract, tort, strict liability or under any other legal theory, for incidental, indirect, special or consequential damages, including but not limited to labor charges, regardless of whether TFBP was informed about the possibility of such damages, and in no event shall TFBP's liability exceed an amount equal to the sales price.

The foregoing warranty is made in lieu of any and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose.

This limited warranty sets forth the exclusive remedy for claims based on failure of or defect in products, materials or components, whether the claim is made in contract, tort, strict liability or any other legal theory.

This warranty will apply to the full extent permitted by law. The invalidity, in whole or part, of any portion of this warranty will not affect the remainder.

Ordering Procedure

When placing an order, indicate the full product name. Contact your local distributor for availability..

Sprinkler Assembly:

Series LFII (TY2234), K=4.9, Residential Pendent Sprinkler with (specify) temperature rating and (specify) finish, P/N (specify).

155°F/68°C or Chrome Plated	P/N 51-201-9-155
155°F/68°C White Polyester	P/N 51-201-4-155
155°F/68°C White (RAL9010)*	P/N 51-201-3-155
155°F/68°C Natural Brass	P/N 51-201-1-155
175°F/79°C or Chrome Plated	P/N 51-201-9-175
175°F/79°C White Polyester	P/N 51-201-4-175
175°F/79°C White (RAL9010)*	P/N 51-201-3-175
175°F/79°C Natural Brass	P/N 51-201-1-175

*Eastern Hemisphere sales only.

Recessed Escutcheon:

Specify: Style 20 Recessed Escutcheon with (specify*) finish, P/N (specify*).

*Refer to Technical Data Sheet TFP770.

Sprinkler Wrench:

Specify: W-Type 6 Sprinkler Wrench, P/N 56-000-6-387.

Specify: W-Type 7 Sprinkler Wrench, P/N 56-850-4-001.

tyco Fire Suppression & Building Products

WORLDWIDE HEADQUARTERS
Tyco Fire Suppression & Building Products
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