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AN ANALYSIS OF SPRINKLER OPERATING TIMES
TESTS P-1 THROUGH P-5
NFPRF SPONSORED TESTS-1997/1998
NISTIR 6196-1

TEST P-1

(Vents Provided; No Vents Operated; No Draft Curtains; 20 Sprinkler Activations)

Sprinkler Operation Times:

1:16
2:14
2:51
5:03
8:31
8:35
9:22
10:19
10:35
11:08
11:11
12:23
12:34
12:45
12:57
13:09
13:25
13:30
13:34
13:41

Note: Times shown in **blue** are the activation times of sprinklers operating directly over the fire. Times shown in **red** are the activation times of sprinklers which were involved in "pre-wetting".

In this test, the first two sprinklers which activated discharged water spray directly over the fire. An additional 13 sprinklers operated and performed the "pre-wetting" function.

Commentary: A total of three sprinklers operated in the first 2 minutes, 51 seconds after ignition. Additional sprinklers began to operate at 8 minutes, 31 seconds after ignition. **This is indicative that the first three operating sprinklers did not gain control of the fire.**

TEST P-2

(Vents Provided; 1 Vent Operated at 6:04; No Draft Curtains; 23+ Sprinkler Activations)

Sprinkler Operation Times:

1:40
1:48
1:55
2:01
2:30
2:32
2:34
2:55
2:58
3:04
3:05
3:13
3:54
3:54
4:06
4:30
4:34
4:43
5:02
5:12
5:24
5:37
5:37

Note: Times shown in **blue** are the activation times of sprinklers operating directly over the fire. Times shown in **red** are the activation times of sprinklers which were involved in "pre-wetting".

In this test, the first two sprinklers which activated discharged water spray directly over the fire. An additional 12 sprinklers operated and performed the "pre-wetting" function.

Commentary: A total of four sprinklers operate in the first 2 minutes and 1 second after ignition. Additional sprinklers continue to operate between 2 minutes and 30 seconds and five minutes, 37 seconds. **This is indicative that the first four operating sprinklers did not initially gain control of the fire.**

TEST P-3

(Vents Provided; 1 Vent Operated at 4:11; Draft Curtains Provided; 19+ Sprinkler Activations)

Sprinkler Operation Times:

1:07	
1:12	
1:45	
2:03	
2:11	
4:02	**(Operation Affected by Draft Curtain)**
5:07	**(Operation Affected by Draft Curtain)**
5:33	**(Opposite side of Draft Curtain-Operation Delayed)**
6:36	**(Opposite Side of Draft Curtain-Operation Delayed)**
7:01	**(Operating Time Potentially Affected by Open Vent)**
7:01	**(Operation Affected by Draft Curtain)**
7:02	**(Opposite side of Draft Curtain-Operation Delayed)**
8:52	**(Opposite Side of Draft Curtain-Operation Delayed)**
9:39	**(Operation Affected by Draft Curtain)**
9:41	**(Opposite side of Draft Curtain-Operation Delayed)**
10:27	
12:08	**(Opposite side of Draft Curtain-Operation Delayed)**
12:30	**(Opposite side of Draft Curtain-Operation Delayed)**
16:06	**(Opposite side of Draft Curtain-Operation Delayed)**

Note: Times shown in **blue** are the activation times of sprinklers operating directly over the fire. Times shown in **red** are the activation times of sprinklers which were involved in "pre-wetting".

In this test, the first two sprinklers which activated discharged water spray directly over the fire. An additional 12 sprinklers operated and performed the "pre-wetting" function.

Commentary: A total of five sprinklers operate in the first 2 minutes and 11 seconds after ignition. Additional sprinklers begin to operate at 4 minutes, 2 seconds. This is indicative that the first five operating sprinklers did not gain control of the fire.

This test also demonstrates the effect of an open roof vent on the activation of sprinklers. It should be noted that sprinklers on the opposite side of a draft curtain operated while sprinkler on the opposite side of the open vent did not open.

TEST P-4
(Vents Provided; No Vents Opened; Draft Curtains Provided; 5 Sprinkler Activations)

1:33
1:34
2:20
3:19
3:20

Note: Times shown in **blue** are the activation times of sprinklers operating directly over the fire. Times shown in **red** are the activation times of sprinklers which were are involved in "pre-wetting".

In this test, the first two sprinklers which activated discharged water spray directly over the fire. An additional 3 sprinklers operated and performed the "pre-wetting" function.

Commentary: A total of 2 sprinklers operate almost simultaneously at 1 minute, 33/34 seconds. An additional 3 sprinklers operate within 2 minutes of the first two sprinklers operating. No additional sprinklers operate after 3 minutes, 20 seconds. The fire was well controlled by the operation of the sprinkler system.

TEST P-5
(Vents Provided; 4 Vents Manually Opened at 1:14; Draft Curtains Provided; 7 Sprinkler Activations)
(No Open Vents Between Operating Sprinklers and Fire)

1:14
1:15
2:26
2:27
3:21
3:33
5:04

Note: Times shown in **blue** are the activation times of sprinklers operating directly over the fire. Times shown in **red** are the activation times of sprinklers which were involved in "pre-wetting".

In this test, the first two sprinklers which activated discharged water spray directly over the fire. An additional 5 sprinklers operated and performed the "pre-wetting" function.

Commentary: A total of 2 sprinklers operate almost simultaneously at 1 minute, 14/15 seconds. An additional 5 sprinklers operate within 4 minutes of the first two sprinklers operating. No additional sprinklers operate after 5 minutes, 4 seconds. The fire was well controlled by the operation of the sprinkler system.

Conclusion: It appears to be a "common sense" statement that the opening of a roof vent could interfere with the activation of a sprinkler or sprinklers where the vent is located between the fire and sprinkler or sprinklers. **The sprinkler activating times in the five large-scale fire tests summarized on previous pages clearly show that the operation of sprinklers involved in "pre-wetting" of unignited combustibles adjacent to the fire could potentially be delayed if roof vents are automatically opened within 12 to 15 minutes of ignition.**

If the opening of roof vents is delayed until 12 minutes after ignition, it is unlikely that the roof vents will perform their intended functions.

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