# National Quick Response Sprinkler Research Project: Preliminary Report of the Group 2 Performance Tests Phase II - ADD Tests

By
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# E X E C U T I V E  S U M M A R Y

Actual Delivered Density (ADD) Tests were conducted using four commercially available state-of-the-art sprinklers consisting of: (1) standard orifice upright, (2) standard orifice pendent, (3) large orifice pendent and (4) residential pendent style sprinklers. A total of 830 ADD water distribution tests were conducted under various test configurations.

The sprinklers were installed at various spacings simulating (1) a single sprinkler with the ignition source located directly below the sprinkler, (2) two sprinklers on the same branch line discharging with the ignition source offset from the two sprinklers and (3) with the ignition centered between four sprinklers with only two diagonal sprinklers flowing water.

The first ADD test configuration consisted of nineteen 1/2 by 1/2 m water collectors arranged to simulate the upholstered furniture fuel package referenced in Phase I of the Group 2 QRS Project. The second ADD test configuration consisted of twenty 1/2 by 1/2 m water collectors arranged to simulate the plastic commodity fuel package referenced in Phase I of the Group 2 QRS Project.

The results of the ADD tests indicate that more water was collected using the upholstered furniture ADD configuration as compared to the plastic commodity ADD configuration. The upholstered furniture ADD test configuration included exposed heptane spray nozzles located directly above four of the water collectors. The simulated plastic commodity ADD test configuration included a 12 in. wide flue space with heptane spray nozzles located inside of and 70 in. below the top edge of the water collectors adjacent to the flue space.

The mean collected water density values for each test as well as characteristic ADD and uniformity values for the 16 water collectors and the four water collectors located directly below the heptane spray nozzles or in the 12 in. wide flue space are documented.

A detailed analysis will be needed to study the interrelationship between the RDD and the ADD test results described in Phase I and Phase II of the Group 2 QRS Performance Tests.

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| | |
|---|---|
| ADD | Actual Delivered Density |
| Branchline | Two sprinklers on the same branchline offset from the heptane nozzles |
| Centered | Sprinkler centered over heptane nozzles |
| Diagonal | Two sprinklers located diagonally with heptane nozzles centered |
| Fig | Figure |
| Ft | Feet |
| gpm | Gallons per minute |
| in. | Inch |
| kW | Kilowatt |
| L/O | Large orifice sprinkler pendent style |
| m | Meter |
| min | Minute |
| NFPA | National Fire Protection Association |
| NFPRF | National Fire Protection Research Foundation |
| No. | Number |
| psi | Pounds per square inch |
| RDD | Required Delivered Density |
| RES | Residential sprinkler pendent style |
| SSP | Spray sprinkler pendent style |
| SSU | Spray sprinkler upright style |
| t | Time |
| vs | Versus |

# I N T R O D U C T I O N

## GENERAL:

The National Fire Protection Research Foundation (NFPRF) sponsored a series of Required Delivered Density (RDD) tests to determine the suppressibility of: (1) an upholstered furniture fuel package and (2) a plastic commodity fuel package at various combinations of heat release rates and delivered density. The results of these tests are presented in the Report on the Quick Response Sprinkler Project Group 2 Performance Tests, Phase I-RDD Tests, dated March 25, 1988.

This Report covers Phase II of a two phase program and deals with the measurement of the Actual Delivered Density (ADD) from four state-of-the-art sprinklers which actually reaches the burning fuel surface under various combinations of sprinkler installation configurations, deflector to water collector clearances, flowing pressures and rates of heat release to determine the interrelationship between these variables. This data is intended for analysis by the Quick Response Sprinkler Project Group 2 data analysis subcommittee to determine whether the influence of the upward fire plume velocity causes a significant difference between the ADD and the local density tests conducted by discharging water under a "no fire" condition.

## OBJECTIVE - PHASE II:

The objective of Phase II of this research investigation was to determine the influence of the upward fire plume velocity simulating the types of fires conducted in the Phase I RDD Tests on the ability of state-of-the-art sprinklers to deliver water onto the burning fuel surface.

## TEST PLAN:

It was planned that the ADD tests would be conducted using state-of-the-art sprinklers under the following test parameters:

- 4 Sprinklers - Standard orifice pendent style (SSP)
  - Standard orifice upright style (SSU)
  - Large orifice pendent style (L/O)
  - Residential pendent style (RES)

| | | |
|---|---|---|
| o | 4 Water Flow Rates | - 15, 28, 40 and 55 gpm per sprinkler (nominal 7, 25, 50 and 100 psi flowing pressures) for the standard orifice and residential sprinklers. |
| | | - 21, 37.5, 52.5 and 75 gpm per sprinkler (nominal 7, 25, 50 and 100 psi flowing pressures) for the large orifice sprinkler. |
| o | 3 Clearances to Collectors | - 1, 2 and 4 m measured between the sprinkler deflector and the top of the water collectors. |
| o | 3 Sprinkler Installation Locations | - Centered - single sprinkler centered over heptane nozzles. |
| | | - Branchline - two sprinklers on same branchline spaced 4 m apart, with heptane nozzles offset. |
| | | - Diagonal - two sprinklers located diagonally on 4 m by 4 m spacing with heptane nozzles centered. |
| o | 4 Heat Release Rates | - 0, 500, 1000 and 1500 kW for the upholstered furniture ADD configuration. |
| | | - 0, 894, 1207 and 1518 kW for the plastic commodity ADD configuration. |
| o | 2 Test Fuel Configurations | - Simulated upholstered furniture fuel package and simulated plastic commodity fuel package described in Phase I-RDD Tests. |

The combination of each of these test parameter variables provides a total of 1152 possible test scenarios. The number of tests were reduced utilizing the following guidelines: (1) if any of the heptane nozzles were extinguished, tests at higher water flow rates were not conducted, and (2) if minimal or no water was collected in the center or flue pans, tests at higher rates of heat release were not conducted. A total of 830 ADD Tests were conducted and the data is recorded in this Phase II Report.

# F A C I L I T I E S

## TEST ROOM:

### GENERAL

The ADD test apparatus was installed in a 30 by 30 by 28 ft high test room. Special equipment and facilities were constructed to facilitate the conduct of the ADD tests in an efficient manner including a movable ceiling, adjacent control room with automated data acquisition equipment, and smoke abatement equipment.

### MOVABLE CEILING

A 20 by 20 ft movable ceiling was installed wherein the height of the ceiling above the floor is adjustable by means of a 4-cable positive displacement electrically operated winch. The movable ceiling provided the desired deflector to top of water collector clearance prior to the conduct of each group of tests.

### WATER SUPPLY

A manifold for supplying water to the test sprinkler(s) and the nozzles for cooling the water collector containers was installed on two 6 in. water mains. One water main was used to supply the cooling water and water for the sprinklers at flowing pressures up to 100 psi. The second 6 in. main was connected to a high pressure water supply and is used to supply water to the sprinklers at higher flowing pressures.

### HEPTANE SUPPLY

The heptane fuel for the spray nozzle manifold was supplied from an underground storage tank. A 5 gpm electrical pump was used to supply heptane at sufficient flow and pressure for the heptane nozzle manifold.

### CONTROL ROOM

The ADD tests were observed and controlled from a positive pressure control room located adjacent to the test room. A computer terminal in the control room was utilized for data acquisition for each ADD test.

## ACTUAL DELIVERED DENSITY TEST APPARATUS:

### GENERAL

The ADD test apparatus consisted of 1/2 m square automatic water collectors, water collector containers and a heptane nozzle manifold. The use of the automated water collection test apparatus provided data of collected water densities under both no-fire and fire conditions.

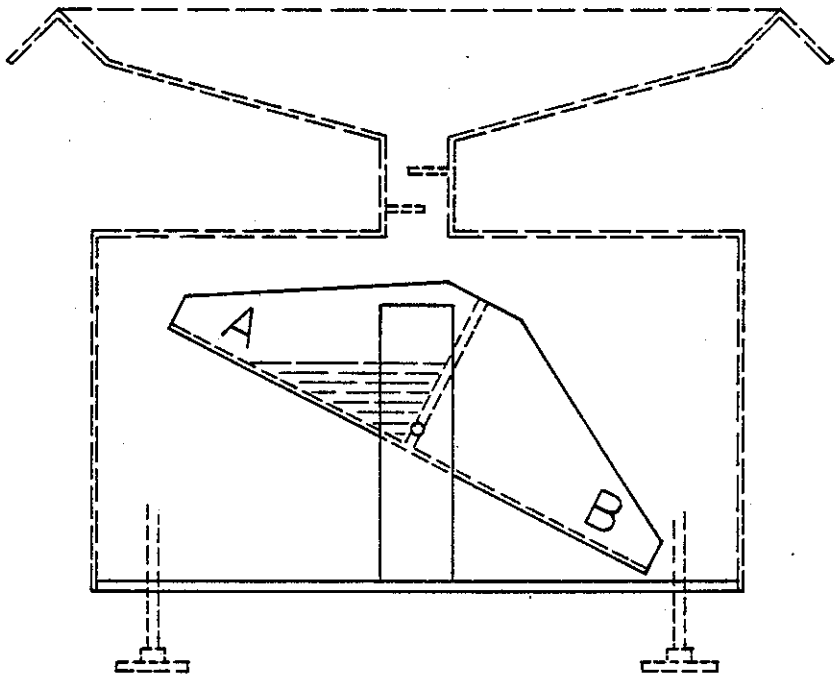
### WATER COLLECTORS

Water collectors were specifically designed and fabricated for the ADD apparatus. Each water collector consists of a divided triangular shaped water reservoir supported on a pivot, counterweights, reed type proximity switch, protective enclosure and a water collector pan. When a preset weight of water is collected in one of the reservoirs, torques about the axis of the pivot cause the reservoirs to rotate, spilling the collected water to waste and permitting water to be collected in the other reservoir. See Fig. 1. This process is repeated as long as a sufficient quantity of water is collected to cause the reservoir to rotate. The water collectors were calibrated to collect weights of water varying from approximately 1 to 3 lb which provided the needed flexibility of accurately recording data from sprinklers having discharge rates used in this project.

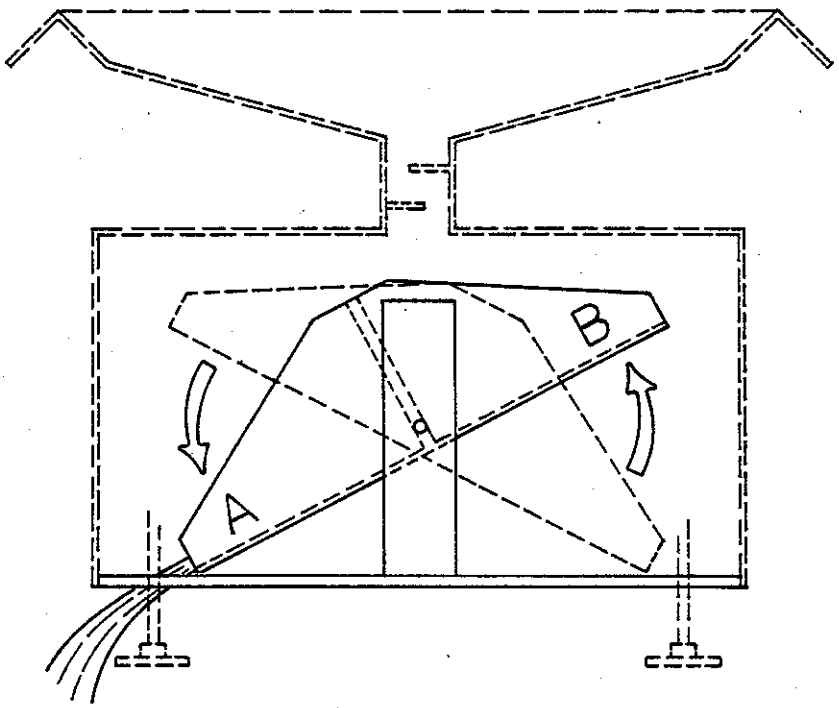
### WATER COLLECTOR CONTAINERS

For the ADD configuration test apparatus, four stainless steel collection containers measuring 42 by 42 by 43 in. high were used to simulate the plastic commodity. Four water collectors were positioned inside of each water collection container so that the amount of water being discharged onto the top of each container could be collected and measured.

Due to the duration and intensity of the fire exposure, each container was provided with a 10 nozzle water cooling manifold to prevent damage to the water collection containers and the water collectors. The amount of cooling water used for each test was controlled, since it affected the total rate of heat release and the fire plume velocities developed at specified heptane flow rates.




SPRINKLER DISCHARGE COLLECTING IN RESERVOIR A OF COLLECTOR.




RESERVOIR A SPILLING TO WASTE WHILE RESERVOIR B IS COLLECTING SPRINKLER DISCHARGE.

FIGURE 1.

WATER COLLECTOR OPERATION

## HEPTANE NOZZLE MANIFOLD

To provide the specified rate of heat release for each test configuration, two heptane nozzle manifolds were used. Each heptane nozzle had an integral stainless steel strainer, a rated flow of 5 gpm at 100 psi and a hollow cone discharge pattern. A discharge spray angle of 70° was selected to ensure a clean burning stable flame having the proper flame height and plume velocity for the desired rates of heat release. The heptane piping to the nozzles was submerged in water to reduce possible vaporization in the heptane piping.

## CALIBRATION

The ADD test configurations were conducted under the calorimeter used in Phase I of the QRS Research Project to determine their rate of heat release.

For the simulated plastic commodity ADD configuration, the entire apparatus including support racks, water collectors, and the water collection containers were placed under the calorimeter collection hood to determine the actual rate of heat release at various heptane flow rates. The results of the calibration included the heat absorbed by the 10 nozzle water cooling manifold located inside of the four large water collector containers. Since no cooling water was involved with the upholstered furniture ADD configuration, the 12 nozzle heptane manifold was tested directly under the calorimeter collection hood.

## DATA ACQUISITION SYSTEM:

A PC computer fitted with a 24 channel digital I/O board was used to interface the computer and the water collectors. The water collectors were connected to the computer in two groups of eight and one group of four. Once per second, the computer recorded each of the three groups of collectors as an eight or four digit binary number. As the individual water collectors tip, the reed proximity switch in each water collector changes from closed to open or open to closed changing the value of the binary number. The numeric values of the binary numbers for the three groups of water collectors versus time are graphically displayed on a monitor so that there is a visual display of the frequency of the water collectors tipping during each test. The first rotation of each water reservoir begins data collection for that collector since it is not known how much water may have been in the reservoir prior to the start of data collection.

Prior to each ADD test, the water and heptane flow rates were adjusted to their specified values, data collection initiated and the test data automatically collected for 5 min. At the end of the test, the data was documented prior to adjustment of the water and/or heptane flow rates for the following test.

## ACTUAL DELIVERED DENSITY TESTS

### UPHOLSTERED FURNITURE ADD CONFIGURATION:

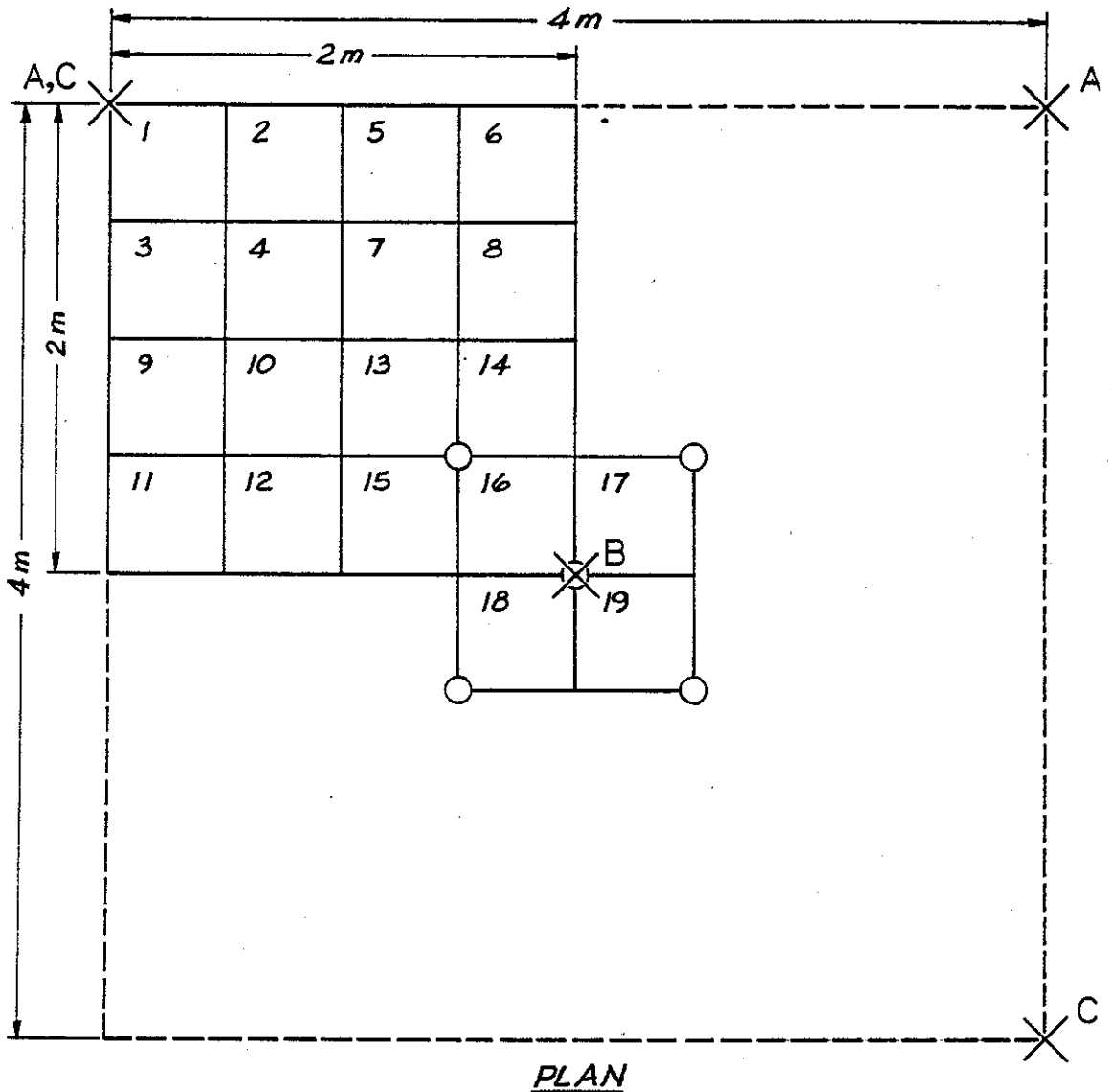
The upholstered furniture ADD configuration was intended to simulate the upholstered furniture corner scenario used for the RDD tests conducted under Phase I of this Project. Sixteen water collectors were arranged in a 4 by 4 configuration, 2 by 2 m area, to collect water in one quadrant of the 4 by 4 m sprinkler spacing. Three additional water collectors were positioned around Pan 16 to form a 1 by 1 m area in the center of the sprinkler spacing. See Figs. 2 and 3.

A 12 nozzle heptane manifold, consisting of four sets of three clustered nozzles, was positioned on top of Pans 16-19. Each cluster of three nozzles was equidistant from each other and 1/2 m from the center of the 4 by 4 m sprinkler spacing.

### SIMULATED PLASTIC COMMODITY ADD CONFIGURATION:

The simulated plastic commodity ADD configuration was intended to simulate the plastic commodity in cardboard carton scenario used in Phase I of this Project. Sixteen water collectors were placed inside of four water collection containers. The water collection containers were placed on two metal racks positioned to provide a 1 ft wide flue space. See Fig. 4. Four additional water collectors were positioned below the water collection containers to collect the density in the flue space.

A 24 nozzle heptane manifold, consisting of eight clusters of three nozzles, was located on top of the four water collectors in the flue space. Each cluster of three nozzles was positioned along the midpoint of the perimeter of each water collector directly below the water collection containers. See Fig. 5. The heptane nozzles were positioned 24 in. above the floor and 28 in. below the bottom of the water collectors.




PLAN

X — SPRINKLER LOCATION (CONFIG. A, B OR C)

○ — HEPTANE NOZZLE LOCATION

A — TWO SPRINKLERS ON SAME BRANCHLINE OFFSET FROM HEPTANE NOZZLES

B — SPRINKLER CENTERED ABOVE HEPTANE NOZZLES

C — TWO SPRINKLERS LOCATED DIAGONALLY WITH HEPTANE NOZZLES CENTERED

FIGURE 2.
UPHOLSTERED FURNITURE
ADD CONFIGURATION

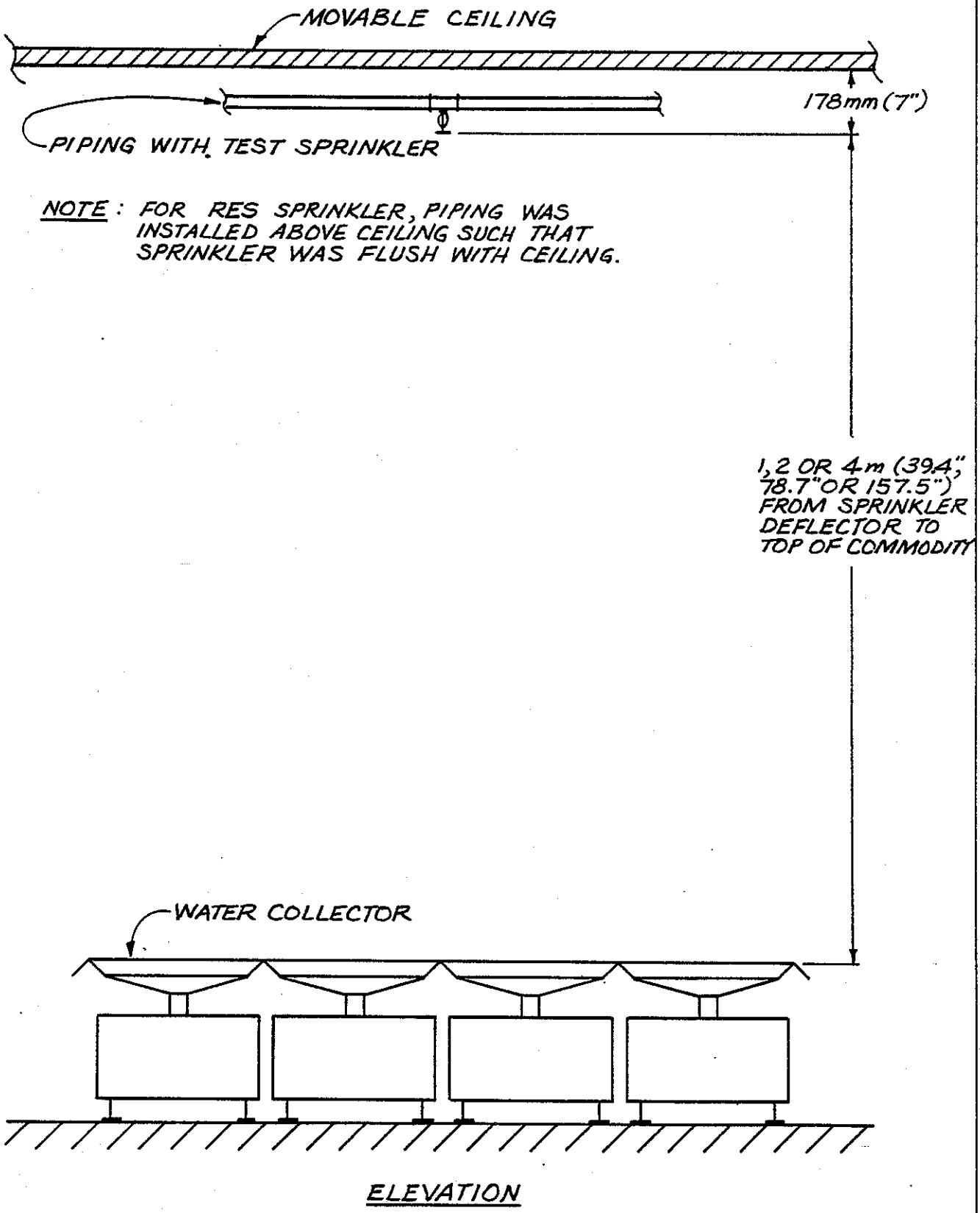
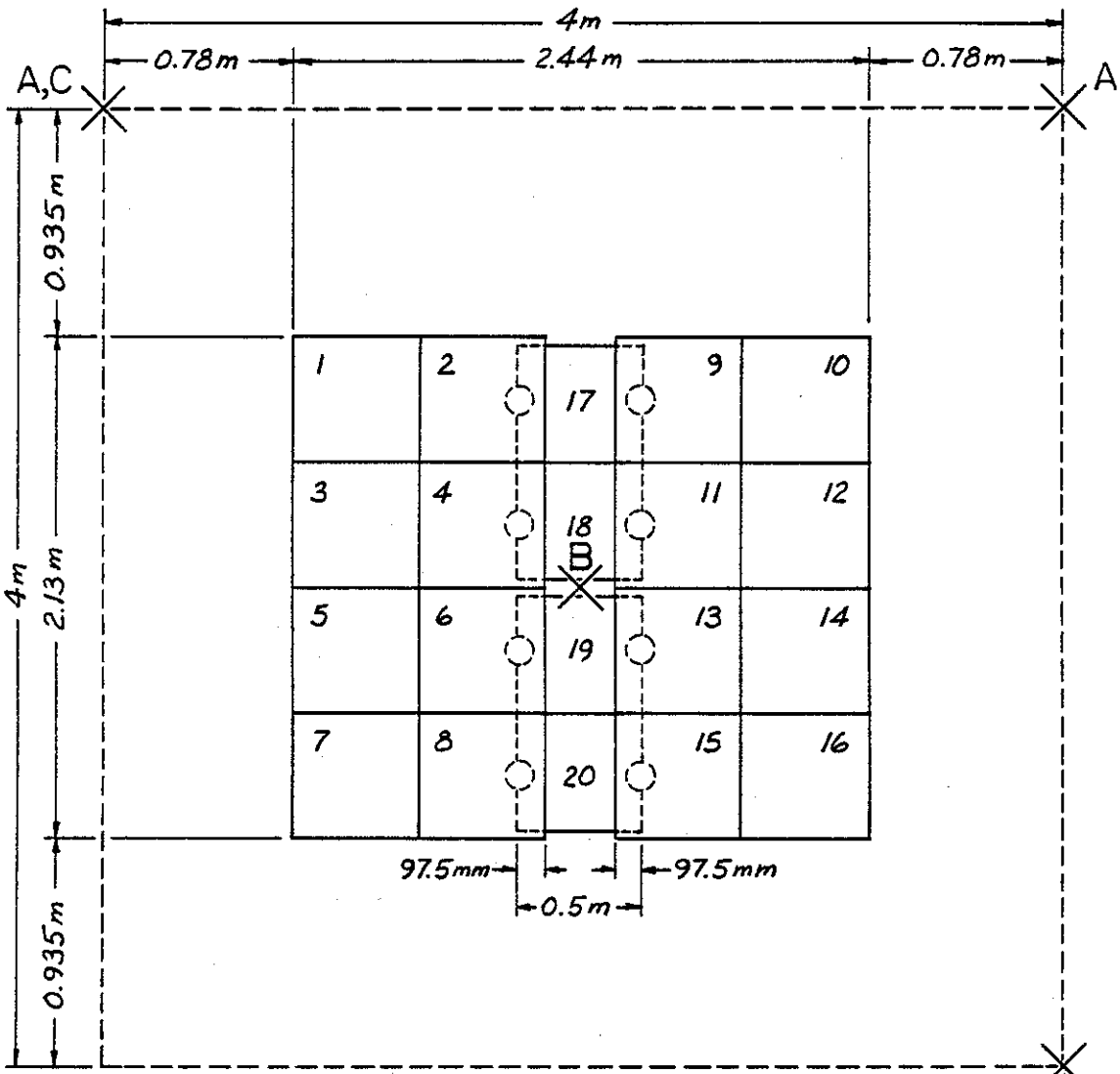



FIGURE 3.
UPHOLSTERED FURNITURE
ADD CONFIGURATION




PLAN

X - SPRINKLER LOCATION (CONFIG. A, B OR C)
O - HEPTANE NOZZLE LOCATION
A - TWO SPRINKLERS ON SAME BRANCHLINE OFFSET FROM HEPTANE NOZZLES
B - SPRINKLER CENTERED ABOVE HEPTANE NOZZLES
C - TWO SPRINKLERS LOCATED DIAGONALLY WITH HEPTANE NOZZLES CENTERED

## FIGURE 4.
## PLASTIC COMMODITY ADD CONFIGURATION

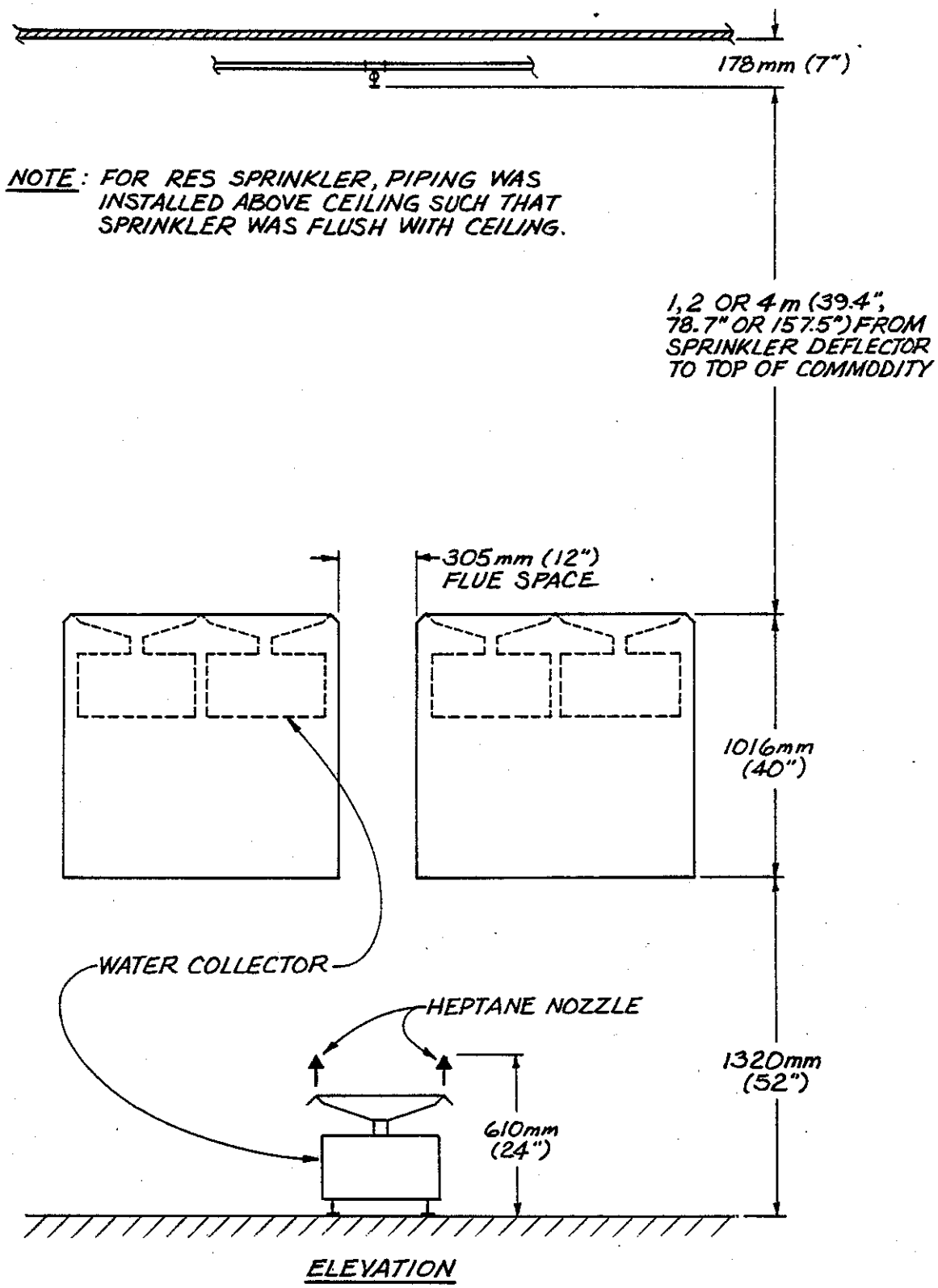



FIGURE 5.
PLASTIC COMMODITY ADD CONFIGURATION

TEST PROCEDURE:

## METHOD

One or two sprinklers were installed on 1 in. piping either directly flush in or below the 20 by 20 ft movable ceiling. For the SSP, SSU and L/O sprinklers, the deflector was positioned 7 in. below the ceiling. For the RES sprinkler, the sprinkler was installed flush with the ceiling. The specified sprinkler deflector to top of water collector dimension was set with the moveable ceiling. The appropriate water flow rate was then established and the amount of water deposited into each water collector was determined under a no-fire condition. The heptane nozzles were ignited and a series of tests conducted at increasing rates of heat release. Water flow rates and rates of heat release were varied so that all specified combinations using the specific sprinkler, sprinkler installation configuration and sprinkler deflector to top of water collector clearance were conducted. The moveable ceiling was adjusted to provide the specified sprinkler deflector to top of water collector clearance and the tests were repeated by varying the water flow rates and rates of heat release. Upon the completion of a series of tests, the sprinklers and/or sprinkler configuration was changed and the next series of tests conducted.

## RESULTS

The results of the simulated upholstered furniture and simulated plastic commodity ADD tests are summarized in Table 1 and the data is tabulated in Tables 2 through 74.

TABLE 1

Summary of ADD Tables

| Sprinkler Location | No. of Sprinklers | Deflector to Pan Clearance, m | Table Number SSP | SSU | L/O | RES |
|---|---|---|---|---|---|---|
| **Simulated Upholstered Furniture Configuration** | | | | | | |
| Centered | 1 | 1 | 2 | 5 | 8 | 11 |
| Centered | 1 | 2 | 3 | 6 | 9 | 12 |
| Centered | 1 | 4 | 4 | 7 | 10 | 13 |
| Branchline | 2 | 1 | 14 | 18 | 21 | 24 |
| Branchline | 2 | 1.5 | 15 | - | - | - |
| Branchline | 2 | 2 | 16 | 19 | 22 | 25 |
| Branchline | 2 | 4 | 17 | 20 | 23 | 26 |
| Diagonal | 2 | 1 | 27 | 30 | 33 | 36 |
| Diagonal | 2 | 2 | 28 | 31 | 34 | 37 |
| Diagonal | 2 | 4 | 29 | 32 | 35 | 38 |
| **Simulated Plastic Commodity Configuration** | | | | | | |
| Centered | 1 | 1 | 39 | 42 | 45 | 48 |
| Centered | 1 | 2 | 40 | 43 | 46 | 49 |
| Centered | 1 | 4 | 41 | 44 | 47 | 50 |
| Branchline | 2 | 1 | 51 | 54 | 57 | 60 |
| Branchline | 2 | 2 | 52 | 55 | 58 | 61 |
| Branchline | 2 | 4 | 53 | 56 | 59 | 62 |
| Diagonal | 2 | 1 | 63 | 66 | 69 | 72 |
| Diagonal | 2 | 2 | 64 | 67 | 70 | 73 |
| Diagonal | 2 | 4 | 65 | 68 | 71 | 74 |

TABLE 2

UPHOLSTERED FURNITURE ADD CONFIGURATION
STANDARD ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 47 | 15 | 0 | .067+ | .043 | .071 | .047 | 1.615 | 4.514 |
| 48 | 15 | 500 | .057 | .034 | .062 | .036 | 5.608 | 6.219 |
| 49 | 15 | 1000 | .053 | .034 | .057 | .037 | 6.170 | 7.563 |
| 50 | 15 | 1500 | .050 | .033 | .053 | .036 | 6.170 | 7.563 |
| 54 | 28 | 0 | .106 | .076 | .118 | .081 | 3.413 | 5.627 |
| 53 | 28 | 500 | .075 | .072 | .084 | .076 | 2.882 | 13.600 |
| 52 | 28 | 1000 | .069 | .067 | .077 | .069 | 3.015 | 18.863 |
| 51 | 28 | 1500 | .068 | .062 | .078 | .065 | 2.732 | 9.522 |
| 55 | 40 | 0 | .165 | .114 | .186 | .118 | 2.580 | 17.347 |
| 56 | 40 | 500 | .164 | .090 | .184 | .093 | 2.883 | 16.572 |
| 57 | 40 | 1000 | .152 | .080 | .171 | .083 | 3.102 | 11.406 |
| 58 | 40 | 1500 | .112 | .074 | .126 | .081 | 2.498 | 5.496 |
| 60 | 55 | 0 | .205+ | .267 | .203 | .285 | .969 | 8.545 |
| 59 | 55 | 1500 | .195+ | .163++ | .196 | .175 | 1.018 | 5.992 |

+ - One or more pans had no collected density.

++ - Several heptane nozzles were extinguished. Tests at lower rates of heat release were not conducted.



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TABLE 3

UPHOLSTERED FURNITURE ADD CONFIGURATION
STANDARD ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 1 | 15 | 0 | .037+ | .007+ | .056 | .004 | .891 | .485 |
| 2 | 15 | 500 | .025+ | .004+ | .025 | .001 | 1.221* | .412 |
| 3 | 15 | 1000 | .023+ | .000+ | .020 | .000 | .695 | - |
| 4 | 15 | 1500 | .022+ | .000+ | .022 | .000 | 1.190 | - |
| 8 | 28 | 0 | .062 | .036 | .070 | .040 | 3.261 | 3.908 |
| 7 | 28 | 500 | .050 | .026 | .056 | .028 | 3.089 | 5.605 |
| 6 | 28 | 1000 | .044+ | .014+ | .047 | .013 | 1.752 | .763 |
| 5 | 28 | 1500 | .038+ | .004+ | .041 | .001 | 1.663 | .407 |
| 9 | 40 | 0 | .126 | .113 | .143 | .117 | 2.566 | 15.090 |
| 10 | 40 | 500 | .113 | .077 | .126 | .086 | 3.806 | 3.226 |
| 11 | 40 | 1000 | .091 | .045 | .162 | .046 | 3.108 | 28.000 |
| 12 | 40 | 1500 | .082 | .032 | .093 | .034 | 2.937 | 5.977 |
| 16 | 55 | 0 | .193+ | .266 | .195 | .292 | 1.042 | 4.613 |
| 15 | 55 | 500 | .159+ | .254 | .155 | .272 | .920 | 7.183 |
| 14 | 55 | 1000 | .152 | .183 | .168 | .201 | 1.531 | 4.210 |
| 13 | 55 | 1500 | .152 | .159 | .171 | .175 | 2.038 | 4.480 |

+ - One or more pans with no collected density.



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TABLE 4

UPHOLSTERED FURNITURE ADD CONFIGURATION
STANDARD ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 61 | 15 | 0 | .027 | .042 | .029 | .048 | 5.000 | 2.123 |
| 62 | 15 | 500 | .014+ | .000+ | .011 | .000 | .629 | - |
| 63 | 15 | 1000 | .010+ | .000+ | .004 | .000 | .415 | - |
| 64 | 15 | 1500 | .007+ | .000+ | .002 | .000 | .393 | - |
| 68 | 28 | 0 | .065 | .042 | .072 | .044 | 3.840 | 21.053 |
| 67 | 28 | 500 | .044+ | .013+ | .047 | .006 | 2.027 | .430 |
| 66 | 28 | 1000 | .038+ | .000+ | .039 | .000 | 1.244 | - |
| 65 | 28 | 1500 | .034+ | .000+ | .035 | .000 | 1.251 | - |
| 69 | 40 | 0 | .124 | .107 | .137 | .115 | 4.057 | 6.509 |
| 70 | 40 | 500 | .120 | .092 | .132 | .098 | 4.750 | 9.853 |
| 71 | 40 | 1000 | .089 | .050 | .098 | .054 | 4.187 | 5.284 |
| 72 | 40 | 1500 | .081 | .032 | .089 | .037 | 4.187 | 2.575 |
| 76 | 55 | 0 | .185+ | .249 | .171 | .276 | .827 | 3.916 |
| 75 | 55 | 500 | .174 | .163 | .195 | .178 | 2.966 | 5.499 |
| 74 | 55 | 1000 | .158 | .100 | .177 | .100 | 2.859 | 28.000 |
| 73 | 55 | 1500 | .146 | .082 | .162 | .085 | 3.849 | 10.918 |

+ - One or more pans had no collected density.



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TABLE 5

UPHOLSTERED FURNITURE ADD CONFIGURATION
STANDARD ORIFICE UPRIGHT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 192 | 15 | 0 | .046+ | .102 | .014 | .110 | .349 | 5.728 |
| 193 | 15 | 500 | .057+ | .083 | .020 | .088 | .366 | 7.480 |
| 194 | 15 | 1000 | .055+ | .083 | .016 | .088 | .341 | 8.404 |
| 202 | 28 | 0 | .085+ | .210 | .038 | .223 | .384 | 7.789 |
| 196 | 28 | 500 | .078+ | .130 | .067 | .131 | .644 | 12.272 |
| 195 | 28 | 1000 | .079+ | .135 | .065 | .145 | .641 | 6.513 |
| 197 | 28 | 1500 | .078+ | .130 | .057 | .137 | .540 | 9.631 |
| 203 | 40 | 0 | .110+ | .235 | .066 | .251 | .475 | 7.420 |
| 200 | 40 | 500 | .098+ | .212 | .077 | .225 | .606 | 8.764 |
| 199 | 40 | 1000 | .102+ | .173 | .087 | .180 | .651 | 12.138 |
| 198 | 40 | 1500 | .091+ | .173 | .085 | .185 | .829 | 7.351 |
| 206 | 55 | 500 | .136+ | .242 | .087 | .272 | .529 | 2.920 |
| 204 | 55 | 1500 | .121+ | .187 | .095 | .212 | .653 | 2.337 |

+ - One or more pans had no collected density.



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TABLE 6

UPHOLSTERED FURNITURE ADD CONFIGURATION
STANDARD ORIFICE UPRIGHT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 208 | 15 | 0 | .058+ | .078 | .048 | .086 | .665 | 3.599 |
| 209 | 15 | 500 | .055+ | .068 | .053 | .074 | .897 | 4.610 |
| 210 | 15 | 1000 | .050+ | .063 | .041 | .069 | .604 | 3.880 |
| 211 | 15 | 1500 | .049+ | .061 | .040 | .069 | .605 | 2.803 |
| 221 | 28 | 0 | .106+ | .109 | .111 | .117 | 1.261 | 6.920 |
| 214 | 28 | 500 | .092 | .094 | .103 | .107 | 1.881 | 2.782 |
| 213 | 28 | 1000 | .085 | .088 | .096 | .100 | 1.902 | 2.442 |
| 212 | 28 | 1500 | .081+ | .086 | .080 | .097 | .949 | 2.810 |
| 220 | 40 | 0 | .133 | .136 | .139 | .139 | 1.617 | 7.912 |
| 215 | 40 | 500 | .130 | .112 | .147 | .122 | 2.162 | 5.506 |
| 216 | 40 | 1000 | .115 | .105 | .130 | .119 | 1.780 | 2.998 |
| 217 | 40 | 1500 | .111 | .101 | .117 | .114 | 1.257 | 1.901 |
| 219 | 55 | 0 | .128+ | .159 | .131 | .167 | 1.077 | 12.850 |
| 218 | 55 | 1500 | .161+ | .102+ | .157 | .081 | .896 | .561 |

+ - One or more pans had no collected density.

TABLE 7

UPHOLSTERED FURNITURE ADD CONFIGURATION
STANDARD ORIFICE UPRIGHT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 177 | 15 | 0 | .034+ | .045 | .031 | .051 | .773 | 1.683 |
| 178 | 15 | 500 | .023+ | .031+ | .017 | .026 | .559 | .653 |
| 179 | 15 | 1000 | .020+ | .027+ | .013 | .022 | .497 | .657 |
| 191 | 28 | 0 | .061 | .105 | .069 | .117 | 2.366 | 4.224 |
| 180 | 28 | 500 | .037 | .068 | .042 | .077 | 2.954 | 2.375 |
| 181 | 28 | 1000 | .036+ | .064 | .039 | .072 | 1.574 | 1.849 |
| 182 | 28 | 1500 | .031+ | .050+ | .048 | .040 | .769 | .590 |
| 190 | 40 | 0 | .105 | .129 | .118 | .141 | 2.738 | 5.098 |
| 185 | 40 | 500 | .062 | .077 | .069 | .087 | 2.994 | 2.762 |
| 184 | 40 | 1000 | .062 | .063 | .069 | .072 | 2.764 | 2.055 |
| 183 | 40 | 1500 | .057 | .055 | .065 | .062 | 2.552 | 1.589 |
| 189 | 55 | 0 | .178 | .155 | .200 | .168 | 2.736 | 6.265 |
| 186 | 55 | 500 | .167 | .150 | .189 | .152 | 2.177 | 32.304 |
| 187 | 55 | 1000 | .110 | .104 | .127 | .112 | 2.595 | 5.682 |
| 188 | 55 | 1500 | .072 | .061 | .082 | .069 | 2.235 | 3.089 |

+ - One or more pans had no collected density.

TABLE 8

UPHOLSTERED FURNITURE ADD CONFIGURATION
LARGE ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 33 | 21 | 0 | .085+ | .145 | .070 | .156 | .641 | 7.289 |
| 34 | 21 | 500 | .079+ | .135 | .078 | .145 | .952 | 6.873 |
| 35 | 21 | 1000 | .077 | .128 | .087 | .137 | 2.508 | 7.477 |
| 36 | 21 | 1500 | .077 | .124 | .087 | .130 | 2.683 | 10.212 |
| 40 | 37.5 | 0 | .148 | .259 | .166 | .267 | 1.765 | 23.305 |
| 39 | 37.5 | 500 | .129 | .217 | .146 | .223 | 2.125 | 19.794 |
| 38 | 37.5 | 1000 | .118 | .216 | .134 | .221 | 2.107 | 21.971 |
| 37 | 37.5 | 1500 | .115 | .215 | .130 | .218 | 2.139 | 31.233 |
| 41 | 52.5 | 0 | .188+ | .347 | .194 | .355 | 1.135 | 24.104 |
| 43 | 52.5 | 500 | .190 | .341 | .209 | .354 | 1.482 | 13.108 |
| 42 | 52.5 | 1000 | .185+ | .320 | .204 | .332 | 1.515 | 15.768 |
| 44 | 52.5 | 1500 | .190 | .316 | .210 | .329 | 1.543 | 13.013 |
| 46 | 75 | 0 | .189 | .419 | .228 | .570 | .735 | 4.668 |
| 45 | 75 | 1500 | .190 | .316++ | .171 | .520 | .519 | 7.149 |

\+ - One or more pans had no collected density.

++ - Several heptane nozzles were extinguished. Tests at lower rates of heat release were not conducted.



DW1B:pr

TABLE 9

UPHOLSTERED FURNITURE ADD CONFIGURATION
LARGE ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² PANS 1-16 | COLLECTED DENSITY, GPM/FT² PANS 16-19 | CHARACTERISTIC ADD, GPM/FT² PANS 1-16 | CHARACTERISTIC ADD, GPM/FT² PANS 16-19 | UNIFORMITY VALUE PANS 1-16 | UNIFORMITY VALUE PANS 1-19 |
|---|---|---|---|---|---|---|---|---|
| 17 | 21 | 0 | .072 | .040 | .080 | .045 | 3.188 | 3.001 |
| 18 | 21 | 500 | .049 | .029 | .056 | .033 | 2.574 | 3.555 |
| 19 | 21 | 1000 | .044 | .017+ | .050 | .015 | 2.407 | .742 |
| 20 | 21 | 1500 | .040+ | .010+ | .043 | .005 | 1.649 | .452 |
| 24 | 37.5 | 0 | .110 | .102 | .122 | .108 | 3.332 | 9.606 |
| 23 | 37.5 | 500 | .077 | .050 | .086 | .052 | 3.223 | 9.841 |
| 22 | 37.5 | 1000 | .074 | .041 | .082 | .043 | 3.226 | 9.927 |
| 21 | 37.5 | 1500 | .069 | .033 | .077 | .035 | 3.444 | 8.228 |
| 25 | 52.5 | 0 | .171 | .202 | .193 | .211 | 2.441 | 11.777 |
| 26 | 52.5 | 500 | .140 | .079 | .157 | .085 | 2.789 | 7.923 |
| 27 | 52.5 | 1000 | .117 | .054 | .131 | .058 | 3.085 | 6.457 |
| 28 | 52.5 | 1500 | .094 | .044 | .106 | .045 | 3.083 | 14.978 |
| 32 | 75 | 0 | .222 | .282 | .242 | .296 | 1.367 | 11.872 |
| 31 | 75 | 500 | .206 | .276 | .218 | .284 | 1.197 | 21.894 |
| 30 | 75 | 1000 | .211+ | .195 | .201 | .222 | .876 | 2.272 |
| 29 | 75 | 1500 | .194 | .133 | .210 | .152 | 1.371 | 2.326 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 10

UPHOLSTERED FURNITURE ADD CONFIGURATION
LARGE ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 77 | 21 | 0 | .043 | .026 | .048 | .026 | 2.712 | 14.536 |
| 78 | 21 | 500 | .029 | .014+ | .032 | .013 | 2.668 | .763 |
| 79 | 21 | 1000 | .026+ | .007+ | .028 | .004 | 1.744 | .493 |
| 80 | 21 | 1500 | .021+ | .000+ | .022 | .000 | 1.149 | - |
| 84 | 37.5 | 0 | .095 | .097 | .103 | .101 | 5.299 | 12.395 |
| 83 | 37.5 | 500 | .054 | .040 | .061 | .043 | 3.055 | 5.625 |
| 82 | 37.5 | 1000 | .050+ | .022+ | .054 | .019 | 1.735 | .700 |
| 81 | 37.5 | 1500 | .046+ | .013+ | .050 | .006 | 1.787 | .430 |
| 85 | 52.5 | 0 | .154 | .161 | .175 | .176 | 2.106 | 5.562 |
| 86 | 52.5 | 500 | .094 | .114 | .106 | .125 | 2.567 | 4.416 |
| 87 | 52.5 | 1000 | .084 | .059 | .095 | .064 | 2.659 | 4.336 |
| 88 | 52.5 | 1500 | .072 | .039 | .081 | .043 | 2.860 | 3.600 |
| 92 | 75 | 0 | .178 | .209 | .201 | .228 | 1.681 | 5.085 |
| 91 | 75 | 500 | .141 | .264 | .158 | .273 | 1.740 | 15.045 |
| 90 | 75 | 1000 | .116 | .197 | .131 | .208 | 1.942 | 8.363 |
| 89 | 75 | 1500 | .113 | .158 | .127 | .169 | 1.827 | 6.851 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 11

UPHOLSTERED FURNITURE ADD CONFIGURATION
RESIDENTIAL TYPE SPRINKLER
CENTERED AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 450 | 15 | 0 | .062+ | .156 | .030 | .168 | .408 | 5.908 |
| 454 | 15 | 500 | .056+ | .142 | .036 | .159 | .483 | 3.008 |
| 455 | 15 | 1000 | .055+ | .136 | .035 | .153 | .482 | 2.722 |
| 451 | 28 | 0 | .110+ | .213 | .112 | .230 | 1.077 | 6.018 |
| 457 | 28 | 500 | .096 | .206 | .109 | .211 | 1.999 | 22.064 |
| 456 | 28 | 1000 | .090 | .195 | .102 | .198 | 1.979 | 35.160 |
| 452 | 40 | 0 | .106 | .179 | .121 | .186 | 1.965 | 13.418 |
| 458 | 40 | 500 | .098 | .232 | .111 | .243 | 1.677 | 11.415 |
| 459 | 40 | 1000 | .096 | .248 | .108 | .259 | 1.562 | 11.875 |
| 460 | 40 | 1500 | .089 | .111 | .099 | .262 | 1.427 | 8.194 |
| 453 | 55 | 0 | .129 | .291 | .147 | .327 | 2.409 | 3.228 |
| 461 | 55 | 1500 | .122 | .321++ | .139 | .357 | 2.262 | 3.920 |

\+ - One or more pans had no collected density.

++ - Heptane nozzles were extinguished. Tests at lower rates of heat release were not conducted.



DW1B:pr

TABLE 12

UPHOLSTERED FURNITURE ADD CONFIGURATION
RESIDENTIAL TYPE SPRINKLER
CENTERED AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 434 | 15 | 0 | .050+ | .135 | .053 | .137 | 1.208 | 25.814 |
| 438 | 15 | 500 | .039+ | .099 | .039 | .106 | 1.032 | 7.185 |
| 439 | 15 | 1000 | .035+ | .089 | .033 | .097 | .811 | 5.301 |
| 440 | 15 | 1500 | .032+ | .077 | .031 | .083 | .824 | 5.891 |
| 435 | 28 | 0 | .086 | .204 | .097 | .214 | 2.321 | 9.837 |
| 443 | 28 | 500 | .070 | .145 | .079 | .155 | 1.719 | 7.503 |
| 442 | 28 | 1000 | .063+ | .118 | .066 | .124 | 1.325 | 7.911 |
| 441 | 28 | 1500 | .056+ | .116 | .060 | .126 | 1.331 | 5.620 |
| 436 | 40 | 0 | .072 | .167 | .082 | .184 | 1.732 | 4.367 |
| 444 | 40 | 500 | .091 | .135 | .102 | .150 | 2.761 | 3.314 |
| 446 | 40 | 1500 | .051 | .081 | .057 | .091 | 3.045 | 2.733 |
| 437 | 55 | 0 | .119 | .190 | .134 | .207 | 1.649 | 5.816 |
| 449 | 55 | 500 | .160 | .138 | .179 | .154 | 3.282 | 3.663 |
| 448 | 55 | 1000 | .142 | .126 | .160 | .135 | 2.737 | 7.193 |
| 447 | 55 | 1500 | .128 | .114 | .145 | .121 | 2.515 | 7.891 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 13

UPHOLSTERED FURNITURE ADD CONFIGURATION
RESIDENTIAL TYPE SPRINKLER
CENTERED AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 462 | 15 | 0 | .040 | .075 | .044 | .081 | 2.659 | 5.288 |
| 466 | 15 | 500 | .028+ | .066 | .029 | .073 | 1.193 | 4.376 |
| 467 | 15 | 1000 | .025+ | .060 | .026 | .064 | 1.257 | 6.731 |
| 468 | 15 | 1500 | .020+ | .051 | .020 | .054 | 1.178 | 8.325 |
| 463 | 28 | 0 | .049 | .083 | .055 | .086 | 2.004 | 15.845 |
| 471 | 28 | 500 | .047 | .089 | .052 | .094 | 3.368 | 7.967 |
| 470 | 28 | 1000 | .039 | .076 | .042 | .083 | 5.303 | 5.457 |
| 469 | 28 | 1500 | .036 | .066 | .039 | .070 | 6.693 | 7.641 |
| 464 | 40 | 0 | .084 | .089 | .096 | .126 | 1.815 | 5.657 |
| 472 | 40 | 500 | .085 | .076 | .095 | .083 | 2.970 | 5.205 |
| 473 | 40 | 1000 | .057 | .051 | .062 | .054 | 5.017 | 8.175 |
| 474 | 40 | 1500 | .047 | .032 | .051 | .034 | 5.295 | 6.170 |
| 465 | 55 | 0 | .140 | .154 | .152 | .163 | 5.911 | 10.662 |
| 477 | 55 | 500 | .101 | .127 | .115 | .137 | 2.335 | 5.946 |
| 476 | 55 | 1000 | .100 | .093 | .113 | .104 | 2.369 | 3.599 |
| 475 | 55 | 1500 | .088 | .079 | .100 | .087 | 2.250 | 3.897 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 14

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 93 | 30 | 0 | .061+ | .000+ | .061 | .000 | 1.007 | - |
| 94 | 30 | 500 | .062+ | .000+ | .066 | .000 | 1.697 | - |
| 100 | 56 | 0 | .106 | .024+ | .116 | .010 | 4.448 | .390 |
| 95 | 56 | 500 | .109 | .052 | .118 | .059 | 5.363 | 3.139 |
| 99 | 80 | 0 | .162 | .035 | .180 | .039 | 3.480 | 1.777 |
| 96 | 80 | 500 | .164 | .046 | .182 | .052 | 3.890 | 1.834 |
| 98 | 110 | 0 | .206 | .005+ | .231 | .001 | 1.840 | .398 |
| 97 | 110 | 500 | .214 | .007+ | .240 | .002 | 1.830 | .369 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 15

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 1.5 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 123 | 15 | 0 | .062 | .009+ | .069 | .002 | 2.581 | .355 |
| 127 | 15 | 500 | .067 | .008+ | .074 | .002 | 3.028 | .366 |
| 124 | 28 | 0 | .113 | .099 | .128 | .106 | 2.352 | 6.112 |
| 129 | 28 | 500 | .114 | .093 | .127 | .104 | 2.700 | 3.104 |
| 125 | 40 | 0 | .161 | .086 | .177 | .096 | 4.541 | 1.573 |
| 130 | 40 | 500 | .167 | .112 | .183 | .128 | 4.098 | 2.716 |
| 131 | 40 | 1000 | .165 | .131 | .181 | .139 | 3.961 | 4.456 |
| 126 | 55 | 0 | .189 | .043+ | .231 | .029 | 2.740 | .539 |
| 128 | 55 | 500 | .192 | .034+ | .217 | .013 | 2.497 | .366 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 16

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 132 | 30 | 0 | .051 | .057 | .057 | .060 | 1.630 | 7.875 |
| 133 | 30 | 500 | .052 | .063 | .057 | .066 | 1.646 | 11.428 |
| 134 | 56 | 500 | .085 | .071 | .094 | .072 | 3.625 | 39.700 |
| 135 | 56 | 1000 | .086 | .118 | .096 | .131 | 3.326 | 3.453 |
| 136 | 56 | 1500 | .077 | .047 | .086 | .050 | 2.858 | 16.561 |
| 139 | 80 | 500 | .133 | .114 | .148 | .116 | 3.338 | 31.986 |
| 140 | 80 | 1000 | .132 | .102 | .147 | .109 | 3.360 | 8.786 |
| 137 | 80 | 1500 | .134 | .081 | .147 | .087 | 3.675 | 7.967 |
| 141 | 110 | 0 | .186 | .122 | .205 | .138 | 3.958 | 2.279 |
| 142 | 110 | 500 | .170 | .106 | .190 | .114 | 3.190 | 6.299 |
| 143 | 110 | 1000 | .150 | .070 | .170 | .080 | 2.290 | 2.024 |
| 144 | 110 | 1500 | .159 | .087 | .179 | .097 | 2.572 | 4.168 |

TABLE 17

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 145 | 30 | 0 | .037+ | .050 | .040 | .052 | 1.671 | 10.773 |
| 146 | 30 | 500 | .035 | .039 | .040 | .042 | 2.2710 | 5.374 |
| 147 | 30 | 1000 | .033 | .036 | .037 | .039 | 2.677 | 9.620 |
| 148 | 30 | 1500 | .031+ | .029 | .033 | .032 | 1.852 | 3.428 |
| 160 | 56 | 0 | .073 | .069 | .079 | .069 | 5.249 | 40.000 |
| 151 | 56 | 500 | .073 | .047 | .079 | .050 | 6.079 | 12.302 |
| 150 | 56 | 1000 | .068 | .037 | .073 | .039 | 5.958 | 12.740 |
| 149 | 56 | 1500 | .065 | .025+ | .070 | .022 | 5.886 | .705 |
| 159 | 80 | 0 | .125 | .121 | .134 | .131 | 7.665 | 5.874 |
| 152 | 80 | 500 | .118 | .114 | .129 | .124 | 4.889 | 4.867 |
| 153 | 80 | 1000 | .116 | .079 | .124 | .089 | 7.047 | 3.690 |
| 154 | 80 | 1500 | .099 | .068 | .110 | .076 | 3.166 | 3.376 |
| 158 | 110 | 0 | .200 | .147 | .216 | .167 | 5.598 | 2.461 |
| 157 | 110 | 500 | .151 | .124 | .168 | .133 | 3.570 | 7.208 |
| 156 | 110 | 1000 | .150 | .092 | .170 | .098 | 2.171 | 7.756 |
| 155 | 110 | 1500 | .145 | .070 | .163 | .076 | 2.853 | 5.569 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 18

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 334 | 30 | 0 | .059+ | .000+ | .011 | .000 | .312 | - |
| 335 | 56 | 0 | .090+ | .000+ | .031 | .000 | .347 | - |
| 336 | 80 | 0 | .123+ | .000+ | .058 | .000 | .407 | - |
| 337 | 110 | 0 | .114+ | .000+ | .079 | .000 | .549 | - |
| 338 | 110 | 500 | .171+ | .000+ | .107 | .000 | .517 | - |

+ - One or more pans had no collected density.

TABLE 19

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 323 | 30 | 0 | .060+ | .000+ | .045 | .000 | .555 | - |
| 327 | 30 | 500 | .062+ | .000+ | .040 | .000 | .478 | - |
| 324 | 56 | 0 | .114 | .016+ | .127 | .014 | 1.684 | .726 |
| 328 | 56 | 500 | .125 | .024+ | .140 | .021 | 1.782 | .688 |
| 329 | 56 | 1000 | .125 | .025+ | .131 | .022 | 1.291 | .022 |
| 331 | 80 | 500 | .125 | .022+ | .139 | .019 | 1.591 | .684 |
| 330 | 80 | 1000 | .130 | .023+ | .145 | .021 | 1.843 | .690 |
| 326 | 110 | 0 | .112+ | .007+ | .077 | .002 | .509 | .373 |
| 332 | 110 | 500 | .117+ | .012+ | .077 | .006 | .500 | .433 |
| 333 | 110 | 1000 | .130+ | .008+ | .110 | .002 | .707 | .362 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 20

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 307 | 30 | 0 | .057 | .023+ | .065 | .020 | 2.438 | .690 |
| 311 | 30 | 500 | .056 | .021+ | .063 | .019 | 2.473 | .693 |
| 312 | 30 | 1000 | .052 | .021+ | .059 | .019 | 2.326 | .699 |
| 308 | 56 | 0 | .105 | .049 | .118 | .054 | 2.559 | 3.419 |
| 316 | 56 | 500 | .102 | .058 | .115 | .064 | 2.769 | 3.948 |
| 315 | 56 | 1000 | .094 | .053 | .106 | .059 | 2.853 | 3.724 |
| 314 | 56 | 1500 | .091 | .053 | .103 | .059 | 2.850 | 4.415 |
| 309 | 80 | 0 | .141 | .059 | .159 | .066 | 2.755 | 3.451 |
| 317 | 80 | 500 | .140 | .065 | .158 | .072 | 2.479 | 4.361 |
| 318 | 80 | 1000 | .142 | .059 | .160 | .065 | 2.389 | 5.068 |
| 319 | 80 | 1500 | .150 | .059 | .169 | .067 | 2.911 | 2.495 |
| 310 | 110 | 0 | .154 | .036 | .174 | .041 | 2.326 | 1.843 |
| 322 | 110 | 500 | .140 | .041+ | .157 | .033 | 1.779 | .617 |
| 321 | 110 | 1000 | .142 | 038+ | .157 | .032 | 1.807 | .625 |
| 320 | 110 | 1500 | .139 | .038 | .157 | .043 | 2.125 | 1.959 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 21

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 101 | 42 | 0 | .087+ | .000+ | .049 | .000 | .438 | - |
| 102 | 42 | 500 | .090+ | .000+ | .073 | .000 | .629 | - |
| 108 | 75 | 0 | .151+ | .000+ | .158 | .000 | 1.194 | - |
| 103 | 75 | 500 | .154+ | .000+ | .161 | .000 | 1.290 | - |
| 107 | 105 | 0 | .177+ | .000+ | .185 | .000 | 1.251 | - |
| 104 | 105 | 500 | .174 | .003+ | .193 | .001 | 1.757 | .429 |
| 106 | 150 | 0 | .250+ | .000+ | .225 | .000 | .791 | - |
| 105 | 150 | 500 | .253+ | .000+ | .209 | .000 | .664 | - |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 22

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 109 | 42 | 0 | .079 | .010+ | .088 | .005 | 3.093 | .451 |
| 113 | 42 | 500 | .077 | .018+ | .086 | .008 | 3.556 | .407 |
| 110 | 75 | 0 | .136 | .089 | .150 | .097 | 4.595 | 4.651 |
| 114 | 75 | 500 | .131 | .088 | .141 | .098 | 5.695 | 3.468 |
| 115 | 75 | 1000 | .123 | .097 | .132 | .106 | 6.105 | 4.739 |
| 116 | 75 | 1500 | .117 | .100 | .126 | .109 | 6.017 | 5.723 |
| 111 | 105 | 0 | .205 | .101 | .223 | .114 | 4.799 | 2.246 |
| 119 | 105 | 500 | .182 | .101 | .201 | .113 | 4.266 | 3.437 |
| 120 | 105 | 1000 | .181 | .101 | .199 | .111 | 4.260 | 3.494 |
| 118 | 105 | 1000 | .177 | .102 | .195 | .112 | 4.167 | 4.076 |
| 117 | 105 | 1500 | .178 | .110 | .196 | .122 | 4.361 | 4.055 |
| 112 | 150 | 0 | .263 | .021+ | .293 | .009 | 3.163 | .397 |
| 121 | 150 | 1000 | .234 | .012+ | .265 | .002 | 2.180 | .337 |
| 122 | 150 | 1500 | .231 | .012+ | .261 | .002 | 2.152 | .341 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 23

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 161 | 42 | 0 | .066 | .080 | .073 | .088 | 3.272 | 4.771 |
| 166 | 42 | 1000 | .054 | .072 | .060 | .075 | 2.978 | 12.091 |
| 167 | 42 | 1500 | .052 | .061 | .058 | .066 | 3.092 | 7.417 |
| 162 | 75 | 0 | .117 | .116 | .126 | .126 | 6.090 | 6.006 |
| 163 | 75 | 500 | .102 | .092 | .110 | .098 | 6.588 | 7.577 |
| 169 | 75 | 1000 | .090 | .074 | .096 | .079 | 7.754 | 6.614 |
| 168 | 75 | 1500 | .089 | .067 | .094 | .072 | 7.167 | 6.339 |
| 170 | 105 | 0 | .193 | .169 | .213 | .184 | 4.539 | 4.759 |
| 171 | 105 | 500 | .151 | .153 | .164 | .160 | 5.254 | 10.897 |
| 172 | 105 | 1000 | .134 | .131 | .145 | .138 | 5.854 | 9.594 |
| 173 | 105 | 1500 | .141 | .109 | .153 | .112 | 5.390 | 19.773 |
| 164 | 150 | 0 | .270 | .185 | .297 | .207 | 4.199 | 3.453 |
| 176 | 150 | 500 | .233 | .129 | .257 | .146 | 3.939 | 2.437 |
| 175 | 150 | 1000 | .211 | .118 | .237 | .134 | 2.941 | 2.514 |
| 174 | 150 | 1500 | .223 | .029+ | .250 | .011 | 2.912 | .378 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 24

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 364 | 30 | 0 | .060+ | .0++ | .060 | .000 | .999 | - |
| 365 | 56 | 0 | .117 | .054 | .133 | .057 | 2.433 | 8.607 |
| 368 | 56 | 500 | .112 | .061 | .127 | .066 | 2.550 | 4.439 |
| 366 | 80 | 0 | .103 | .121 | .117 | .128 | 2.124 | 8.677 |
| 369 | 80 | 500 | .101 | .108 | .114 | .113 | 2.181 | 10.494 |
| 370 | 80 | 1000 | .101 | .096 | .115 | .103 | 1.917 | 6.032 |
| 367 | 110 | 0 | .143 | .168 | .162 | .213 | 2.082 | 5.833 |
| 372 | 110 | 500 | .144 | .121 | .163 | .142 | 2.257 | 7.793 |
| 371 | 110 | 1000 | .139 | .091 | .158 | .099 | 2.078 | 4.928 |

\+ - One or more pans had no collected density.

++ - No water collected. Tests at higher rates of heat release were not conducted.



DW1B:pr

TABLE 25

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 373 | 30 | 0 | .046 | .027 | .052 | .029 | 2.549 | 7.506 |
| 378 | 30 | 500 | .044+ | .043 | .046 | .046 | 1.353 | 6.343 |
| 374 | 56 | 0 | .092 | .067 | .103 | .070 | 2.928 | 14.480 |
| 377 | 56 | 500 | .079 | .055 | .089 | .058 | 2.217 | 8.988 |
| 379 | 56 | 1000 | .070 | .054 | .079 | .053 | 2.805 | 87.000 |
| 375 | 75 | 0 | .102 | .105 | .117 | .114 | 2.242 | 5.954 |
| 394 | 75 | 500 | .101 | .053 | .115 | .057 | 2.012 | 4.947 |
| 380 | 75 | 1000 | .095 | .065 | .108 | .071 | 1.889 | 5.138 |
| 376 | 110 | 0 | .146 | .091 | .165 | .101 | 2.290 | 3.632 |
| 382 | 110 | 500 | .135 | .076 | .153 | .082 | 2.085 | 6.397 |
| 381 | 110 | 1000 | .129 | .060 | .146 | .066 | 2.059 | 3.724 |

+ - One or more pans had no collected density.

TABLE 26

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS ON
THE SAME BRANCHLINE AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 387 | 30 | 500 | .039+ | .051 | .036 | .055 | .805 | 6.770 |
| 388 | 30 | 1000 | .035+ | .046 | .029 | .050 | .643 | 5.272 |
| 384 | 56 | 0 | .064 | .060 | .071 | .063 | 4.232 | 15.599 |
| 390 | 56 | 500 | .072 | .041 | .081 | .045 | 2.741 | 4.641 |
| 389 | 56 | 1000 | .069 | .032 | .078 | .035 | 2.434 | 4.128 |
| 385 | 80 | 0 | .118 | .092 | .133 | .098 | 2.422 | 7.808 |
| 391 | 80 | 500 | .097 | .064 | .110 | .067 | 2.453 | 10.083 |
| 386 | 110 | 0 | .148 | .122 | .168 | .133 | 2.632 | 4.501 |
| 392 | 110 | 500 | .139 | .075 | .157 | .079 | 2.713 | 10.481 |
| 393 | 110 | 1000 | .153 | .067 | .172 | .076 | 3.041 | 3.240 |

+ - One or more pans had no collected density.

TABLE 27

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 264 | 30 | 0 | .058+ | .000+ | .061 | .000 | 1.578 | - |
| 265 | 30 | 500 | .055+ | .000+ | .059 | .000 | 1.838 | - |
| 263 | 56 | 0 | .097 | .069 | .107 | .073 | 3.473 | 7.184 |
| 266 | 56 | 500 | .089 | .067 | .099 | .073 | 3.732 | 5.734 |
| 267 | 56 | 1000 | .086 | .076 | .096 | .081 | 3.411 | 10.660 |
| 262 | 80 | 0 | .150 | .079 | .170 | .084 | 3.576 | 8.980 |
| 269 | 80 | 500 | .143 | .079 | .156 | .084 | 3.185 | 8.348 |
| 268 | 80 | 1000 | .135 | .077 | .155 | .084 | 3.398 | 1.317 |
| 273 | 80 | 1500 | .124 | .075 | .139 | .082 | 3.064 | 5.508 |
| 261 | 110 | 0 | .132 | .033 | .150 | .034 | 2.022 | 8.750 |
| 270 | 110 | 500 | .122 | .035 | .137 | .039 | 1.879 | 2.853 |
| 271 | 110 | 1000 | .127 | .038 | .142 | .043 | 1.627 | 2.643 |
| 272 | 110 | 1500 | .127 | .047 | .142 | .054 | 1.599 | 2.649 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 28

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 274 | 30 | 0 | .042 | .045 | .046 | .048 | 4.367 | 10.119 |
| 275 | 30 | 500 | .035+ | .054 | .038 | .055 | 1.976 | 18.193 |
| 276 | 30 | 1000 | .035 | .052 | .040 | .053 | 4.049 | 40.000 |
| 277 | 30 | 1500 | .035+ | .050 | .037 | .053 | 2.064 | 9.995 |
| 289 | 56 | 0 | .069 | .072 | .075 | .076 | 6.653 | 10.577 |
| 280 | 56 | 500 | .062 | .068 | .067 | .071 | 6.581 | 9.033 |
| 279 | 56 | 1000 | .059 | .057 | .063 | .060 | 7.177 | 13.863 |
| 278 | 56 | 1500 | .059 | .053 | .063 | .057 | 6.972 | 7.074 |
| 288 | 80 | 0 | .113 | .111 | .123 | .117 | 5.287 | 8.329 |
| 281 | 80 | 500 | .106 | .107 | .117 | .116 | 4.148 | 5.852 |
| 282 | 80 | 1000 | .099 | .088 | .108 | .094 | 4.535 | 6.684 |
| 283 | 80 | 1500 | .091 | .076 | .099 | .081 | 5.599 | 7.409 |
| 290 | 110 | 0 | .154 | .090 | .174 | .103 | 2.720 | 1.991 |
| 287 | 110 | 500 | .151 | .126 | .170 | .140 | 2.298 | 3.566 |
| 286 | 110 | 1000 | .154 | .125 | .173 | .139 | 2.474 | 3.613 |
| 284 | 110 | 1500 | .151 | .121 | .168 | .133 | 2.748 | 4.550 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 29

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW. | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 291 | 30 | 0 | .029+ | .048 | .031 | .051 | 1.757 | 9.550 |
| 304 | 30 | 500 | .028+ | .039 | .029 | .041 | 2.005 | 9.987 |
| 305 | 30 | 1000 | .027+ | .031 | .028 | .033 | 1.325 | 5.374 |
| 306 | 30 | 1500 | .029 | .025 | .031 | .028 | 4.811 | 3.875 |
| 292 | 56 | 0 | .057 | .052 | .061 | .054 | 6.198 | 12.433 |
| 303 | 56 | 500 | .054 | .037 | .058 | .038 | 5.695 | 18.811 |
| 302 | 56 | 1000 | .054 | .034 | .058 | .035 | 5.263 | 12.539 |
| 301 | 56 | 1500 | .051 | .022 | .055 | .019 | 5.706 | .715 |
| 293 | 80 | 0 | .099 | .080 | .107 | .084 | 5.870 | 14.780 |
| 298 | 80 | 500 | .093 | .076 | .101 | .082 | 5.235 | 6.477 |
| 299 | 80 | 1000 | .078 | .047 | .086 | .051 | 4.142 | 7.112 |
| 300 | 80 | 1500 | .051 | .029 | .056 | .031 | 4.943 | 9.184 |
| 294 | 110 | 0 | .171 | .125 | .186 | .135 | 5.035 | 5.914 |
| 297 | 110 | 500 | .134 | .105 | .151 | .112 | 2.620 | 6.492 |
| 296 | 110 | 1000 | .121 | .058 | .137 | .059 | 2.119 | 15.588 |
| 295 | 110 | 1500 | .110 | .053 | .124 | .059 | 1.981 | 3.666 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 30

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 339 | 30 | 0 | - | ++ | - | - | - | - |
| 340 | 56 | 0 | .085+ | .000++ | .029 | .000 | .349 | - |
| 341 | 80 | 0 | - | ++ | - | - | - | - |
| 342 | 110 | 0 | .119+ | .000++ | .044 | .000 | .369 | - |
| 343 | 110 | 500 | - | ++ | - | - | - | - |

\+ - One or more pans had no collected density.

++ - No water collected. Tests at higher rates of heat release were not conducted.



DW1B:pr

TABLE 31

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 344 | 30 | 0 | .052+ | .000++ | .028 | .000 | .424 | - |
| 345 | 56 | 0 | .099+ | .023+ | .100 | .020 | 1.030 | .681 |
| 350 | 56 | 500 | .111 | .025 | .123 | .028 | 1.564 | 2.245 |
| 346 | 80 | 0 | .118+ | .045 | .117 | .051 | .973 | 1.700 |
| 349 | 80 | 500 | .126+ | .025+ | .130 | .021 | 1.133 | .664 |
| 347 | 110 | 0 | .130+ | .032+ | .066 | .025 | .417 | .607 |
| 348 | 110 | 500 | .140+ | .008+ | .089 | .002 | .481 | .360 |

\+ - One or more pans had no collected density.

++ - No water collected. Tests at higher rates of heat release were not conducted.



DW1B:pr

TABLE 32

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 363 | 30 | 500 | .044+ | .025 | .045 | .028 | 1.740 | 3.523 |
| 362 | 30 | 1000 | .044+ | .031 | .047 | .033 | 1.690 | 7.081 |
| 361 | 30 | 1500 | .045 | .021+ | .051 | .018 | 2.667 | .685 |
| 358 | 56 | 500 | .077 | .077 | .086 | .079 | 3.445 | 17.048 |
| 359 | 56 | 1000 | .071 | .067 | .081 | .073 | 2.689 | 4.724 |
| 360 | 56 | 1500 | .066 | .059 | .074 | .064 | 2.942 | 6.727 |
| 357 | 80 | 500 | .126 | .058 | .142 | .062 | 3.152 | 9.481 |
| 356 | 80 | 1000 | .136 | .062 | .152 | .066 | 3.333 | 8.203 |
| 355 | 80 | 1500 | .128 | .064 | .144 | .065 | 2.826 | 40.000 |
| 351 | 110 | 0 | .127+ | .018+ | .116 | .008 | .773 | .406 |
| 352 | 110 | 500 | .127+ | .022+ | .119 | .009 | .814 | .394 |
| 353 | 110 | 1000 | .143 | .029 | .158 | .032 | 1.569 | 1.913 |
| 354 | 110 | 1500 | .147 | .040 | .166 | .046 | 1.836 | 2.125 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 33

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 254 | 42 | 0 | .086 | .000+ | .059 | .000 | .519 | - |
| 255 | 75 | 0 | .114 | .008+ | .129 | .004 | 1.739 | .472 |
| 260 | 105 | 0 | .115 | .005+ | .129 | .001 | 1.864 | .394 |
| 257 | 105 | 500 | .112 | .006+ | .126 | .003 | 1.811 | .543 |
| 259 | 150 | 0 | .181+ | .000+ | .164 | .000 | .802 | - |
| 258 | 150 | 500 | .182+ | .000+ | .149 | .000 | .666 | - |

+ - Two or more pans had no collected density.



DW1B:pr

TABLE 34

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 238 | 42 | 0 | .067 | .005+ | .076 | .001 | 2.769 | .394 |
| 239 | 42 | 500 | .067 | .027 | .074 | .031 | 3.773 | 3.803 |
| 240 | 42 | 1000 | .067 | .034 | .074 | .038 | 3.980 | 4.344 |
| 241 | 42 | 1500 | .064 | .029 | .071 | .033 | 4.050 | 2.907 |
| 244 | 75 | 500 | .122 | .066 | .136 | .073 | 3.531 | 3.819 |
| 243 | 75 | 1000 | .113 | .077 | .125 | .084 | 3.678 | 4.843 |
| 242 | 75 | 1500 | .116 | .085 | .129 | .092 | 3.675 | 4.680 |
| 246 | 105 | 0 | .155 | .058 | .176 | .064 | 3.309 | 5.231 |
| 247 | 105 | 500 | .159 | .070 | .178 | .078 | 3.470 | 3.788 |
| 248 | 105 | 1000 | .157 | .068 | .176 | .076 | 3.209 | 3.325 |
| 249 | 105 | 1500 | .161 | .086 | .180 | .097 | 3.584 | 3.078 |
| 253 | 150 | 0 | .153 | .005+ | .165 | .001 | 1.275 | .391 |
| 252 | 150 | 500 | .148+ | .000+ | .150 | .000 | 1.032 | - |
| 251 | 150 | 1000 | .146 | .006+ | .160 | .001 | 1.323 | .378 |
| 250 | 150 | 1500 | .148 | .006+ | .163 | .001 | 1.395 | .387 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 35

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 222 | 42 | 0 | .049 | .069 | .053 | .073 | 4.254 | 10.552 |
| 223 | 42 | 500 | .045 | .065 | .049 | .069 | 4.750 | 9.538 |
| 224 | 42 | 1000 | .044 | .061 | .048 | .065 | 4.655 | 11.489 |
| 225 | 42 | 1500 | .043 | .054 | .047 | .059 | 5.234 | 6.480 |
| 236 | 75 | 0 | .102 | .099 | .110 | .096 | 5.420 | 7.864 |
| 229 | 75 | 500 | .088 | .080 | .092 | .085 | 11.316 | 7.257 |
| 230 | 75 | 1000 | .074 | .053 | .078 | .058 | 8.367 | 4.678 |
| 231 | 75 | 1500 | .072 | .045 | .078 | .051 | 5.379 | 3.576 |
| 235 | 105 | 0 | .143 | .114 | .157 | .124 | 4.588 | 5.195 |
| 234 | 105 | 500 | .127 | .088 | .141 | .096 | 3.484 | 5.616 |
| 233 | 105 | 1000 | .118 | .089 | .130 | .095 | 3.797 | 8.073 |
| 232 | 105 | 1500 | .122 | .081 | .136 | .089 | 3.401 | 4.696 |
| 237 | 150 | 0 | .179 | .110 | .203 | .121 | 2.156 | 4.036 |
| 228 | 150 | 500 | .171 | .127 | .194 | .138 | 2.115 | 5.439 |
| 227 | 150 | 1000 | .139 | .096 | .157 | .098 | 1.721 | 32.383 |
| 226 | 150 | 1500 | .131 | .090 | .147 | .091 | 1.662 | 40.000 |



DW1B:pr

TABLE 36

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 395 | 30 | 0 | .054+ | .000+ | .036 | .000 | .487 | - |
| 399 | 30 | 500 | .057+ | .000+ | .054 | .000 | .868 | - |
| 396 | 58 | 0 | .101 | .035 | .115 | .037 | 1.949 | 6.857 |
| 400 | 58 | 500 | .091 | .061 | .103 | .068 | 2.067 | 3.533 |
| 397 | 75 | 0 | .095 | .075 | .107 | .076 | 1.899 | 39.700 |
| 401 | 75 | 500 | .098 | .079 | .111 | .082 | 1.702 | 19.974 |
| 398 | 110 | 0 | .132 | .151 | .149 | .159 | 2.613 | 11.363 |
| 402 | 110 | 500 | .131 | .113 | .148 | .107 | 2.292 | 6.444 |
| 403 | 110 | 1000 | .127 | .085 | .144 | .092 | 1.891 | 6.190 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 37

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 404 | 30 | 0 | .041+ | .000+ | .044 | .000 | 1.676 | - |
| 408 | 30 | 500 | .034+ | .024 | .032 | .026 | .804 | 9.650 |
| 405 | 56 | 0 | .080 | .067 | .089 | .072 | 3.197 | 9.404 |
| 409 | 56 | 500 | .064 | .064 | .071 | .067 | 3.629 | 11.785 |
| 410 | 56 | 1000 | .061 | .059 | .068 | .062 | 3.202 | 8.926 |
| 411 | 56 | 1500 | .060 | .056 | .068 | .059 | 2.948 | 7.655 |
| 406 | 80 | 0 | .092 | .083 | .104 | .086 | 2.478 | 18.428 |
| 414 | 80 | 500 | .085 | .067 | .096 | .072 | 2.401 | 6.749 |
| 413 | 80 | 1000 | .082 | .063 | .093 | .069 | 2.145 | 5.100 |
| 412 | 80 | 1500 | .079 | .054 | .088 | .055 | 1.792 | 40.000 |
| 407 | 110 | 0 | .176 | .142 | .193 | .156 | 4.308 | 4.755 |
| 415 | 110 | 500 | .146 | .084 | .166 | .090 | 2.415 | 6.597 |
| 416 | 110 | 1000 | .126 | .061 | .142 | .064 | 1.976 | 11.628 |
| 417 | 110 | 1500 | .122 | .051 | .138 | .054 | 1.911 | 8.483 |

+ - One or more pans had no collected density.

TABLE 38

UPHOLSTERED FURNITURE ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 16-19 | PANS 1-16 | PANS 1-19 |
| 418 | 30 | 0 | .028+ | .066 | .026 | .075 | .831 | 2.310 |
| 422 | 30 | 500 | .025+ | .045 | .024 | .045 | .842 | 27.538 |
| 423 | 30 | 1000 | .023+ | .043 | .020 | .044 | .678 | 18.000 |
| 424 | 30 | 1500 | .024+ | .041 | .022 | .043 | .845 | 17.743 |
| 419 | 56 | 0 | .067 | .073 | .075 | .075 | 3.176 | 21.179 |
| 427 | 56 | 500 | .053 | .061 | .060 | .066 | 2.767 | 6.890 |
| 426 | 56 | 1000 | .054 | .048 | .064 | .051 | 2.467 | 12.315 |
| 425 | 56 | 1500 | .051 | .045 | .058 | .048 | 2.041 | 6.644 |
| 420 | 80 | 0 | .101 | .096 | .112 | .100 | 3.625 | 81.000 |
| 428 | 80 | 500 | .098 | .091 | .111 | .094 | 2.587 | 17.504 |
| 429 | 80 | 1000 | .093 | .067 | .105 | .070 | 2.533 | 18.773 |
| 430 | 80 | 1500 | .090 | .056 | .102 | .058 | 2.283 | 11.033 |
| 421 | 110 | 0 | .155 | .137 | .173 | .144 | 3.209 | 10.590 |
| 433 | 110 | 500 | .152 | .082 | .170 | .088 | 3.126 | 6.302 |
| 432 | 110 | 1000 | .149 | .078 | .167 | .087 | 3.174 | 3.271 |
| 431 | 110 | 1500 | .142 | .068 | .160 | .074 | 3.055 | 4.178 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 39

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
STANDARD ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 586 | 15 | 0 | .088 | .034+ | .095 | .029 | 5.687 | .639 |
| 590 | 15 | 894 | .066 | .024+ | .071 | .021 | 6.131 | .695 |
| 587 | 28 | 0 | .137 | .070 | .146 | .078 | 6.537 | 3.778 |
| 591 | 28 | 894 | .115 | .050 | .122 | .056 | 7.127 | 3.112 |
| 588 | 40 | 0 | .215 | .090 | .231 | .099 | 6.791 | 4.827 |
| 592 | 40 | 894 | .176 | .095 | .188 | .097 | 6.776 | 6.259 |
| 589 | 55 | 0 | .401 | .115 | .434 | .126 | 5.638 | 4.801 |
| 593 | 55 | 894 | .297 | .042 | .335 | .046 | 2.879 | 5.167 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 40

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
STANDARD ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 594 | 15 | 0 | .032+ | .014+ | .033 | 007 | 1.144 | .427 |
| 598 | 15 | 894 | .025+ | .000+ | .028 | .000 | 1.717 | - |
| 595 | 28 | 0 | .079 | .051 | .088 | .054 | 3.912 | 9.773 |
| 599 | 28 | 894 | .062 | .031+ | .069 | .027 | 3.481 | .678 |
| 596 | 40 | 0 | .137 | .100 | .151 | .104 | 4.081 | 12.263 |
| 600 | 40 | 894 | .108 | .048+ | .119 | .041 | 4.320 | .631 |
| 597 | 55 | 0 | .292 | .309 | .321 | .335 | 4.528 | 5.128 |
| 601 | 55 | 894 | .170 | .043 | .189 | .047 | 3.459 | 5.379 |

+ - One or more pans with no collected density.



DW1B:pr

TABLE 41

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
STANDARD ORIFICE PENDENT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 602 | 15 | 0 | .018+ | .000+ | .018 | .000 | 1.350 | - |
| 606 | 15 | 894 | .006+ | .004+ | .002 | .001 | .427 | .412 |
| 603 | 28 | 0 | .058 | .057 | .063 | .061 | 6.393 | 7.460 |
| 607 | 28 | 894 | .042 | .015+ | .047 | .007 | 3.814 | .422 |
| 604 | 40 | 0 | .109 | .111 | .118 | .121 | 6.029 | 5.730 |
| 608 | 40 | 894 | .088 | .055 | .096 | .063 | 4.647 | 2.480 |
| 605 | 55 | 0 | .196 | .353 | .217 | .365 | 3.775 | 18.290 |
| 609 | 55 | 894 | .154 | .040 | .168 | .033 | 4.444 | .626 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 42

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
STANDARD ORIFICE UPRIGHT STYLE SPRINKLER CENTERED
AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 639 | 15 | 0 | .168 | .072 | .190 | .082 | 2.215 | 1.692 |
| 643 | 15 | 894 | .139 | .024+ | .156 | .010 | 2.583 | .388 |
| 640 | 28 | 0 | .254 | .117 | .283 | .133 | 3.323 | 1.828 |
| 644 | 28 | 894 | .192 | .061 | .216 | .068 | 2.813 | 3.462 |
| 641 | 40 | 0 | .354 | .169 | .395 | .188 | 3.416 | 1.460 |
| 645 | 40 | 894 | .253 | .074 | .284 | .084 | 2.582 | 1.655 |
| 642 | 55 | 0 | .488 | .247 | .544 | .255 | 3.278 | 1.062 |
| 646 | 55 | 894 | .342 | .073+ | .384 | .042 | 2.093 | .487 |

+ - One or more pans with no collected density.

TABLE 43

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
STANDARD ORIFICE UPRIGHT STYLE SPRINKLER
CENTERED AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 647 | 15 | 0 | .040 | .004+ | .045 | .001 | 1.676 | .412 |
| 651 | 15 | 894 | .031+ | .007+ | .028 | .002 | .764 | .366 |
| 648 | 28 | 0 | .084 | .035+ | .096 | .031 | 2.083 | .650 |
| 652 | 28 | 894 | .051 | .009+ | .058 | .002 | 2.194 | .355 |
| 649 | 40 | 0 | .137 | .069+ | .155 | .055 | 1.861 | .585 |
| 653 | 40 | 894 | .078 | .016+ | .089 | .007 | 2.132 | .414 |
| 650 | 55 | 0 | .244 | .125 | .276 | .140 | 1.860 | 3.186 |
| 654 | 55 | 894 | .115 | .031+ | .130 | .027 | 1.770 | .668 |

+ - One or more pans with no collected density.

TABLE 44

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
STANDARD ORIFICE UPRIGHT STYLE SPRINKLER CENTERED
AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 655 | 15 | 0 | .013+ | .000+ | .007 | .001 | .469 | .927 |
| 659 | 15 | 894 | .016+ | .008+ | .006 | .002 | .409 | .364 |
| 656 | 28 | 0 | .048 | .042+ | .052 | .035 | 4.789 | .622 |
| 660 | 28 | 894 | .036 | .011+ | .041 | .002 | 1.704 | .343 |
| 657 | 40 | 0 | .090 | .095 | .099 | .108 | 4.099 | 1.898 |
| 661 | 40 | 894 | - | + | - | - | - | - |
| 658 | 55 | 0 | .184 | .207 | .203 | .232 | 3.948 | 2.968 |
| 662 | 55 | 894 | .089 | .026+ | .098 | .011 | 4.354 | .383 |

+ - One or more pans with no collected density.

TABLE 45

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
LARGE ORIFICE PENDENT STYLE SPRINKLER CENTERED AT
A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 610 | 21 | 0 | .154 | .100 | .166 | .113 | 5.826 | 2.850 |
| 614 | 21 | 894 | .119 | .067 | .130 | .075 | 4.855 | 3.700 |
| 611 | 37.5 | 0 | .263 | .256 | .292 | .287 | 3.658 | 3.208 |
| 615 | 37.5 | 894 | .188 | .108 | .205 | .122 | 4.938 | 3.191 |
| 612 | 52.5 | 0 | .346 | .329 | .371 | .365 | 6.260 | 3.690 |
| 616 | 52.5 | 894 | .261 | .086+ | .281 | .065 | 6.404 | .545 |
| 613 | 75 | 0 | .568 | .886 | .638 | .964 | 3.031 | 5.827 |
| 617 | 75 | 894 | .604 | .537 | .682 | .609 | 2.129 | 2.497 |
| 618 | 75 | 1207 | .579 | .284 | .636 | .260 | 4.397 | 3.096 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 46

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
LARGE ORIFICE PENDENT STYLE SPRINKLER CENTERED AT
A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 619 | 21 | 0 | .074 | .051 | .081 | .056 | 4.486 | 4.280 |
| 623 | 21 | 894 | .059 | .010+ | .065 | .002 | 4.480 | .352 |
| 620 | 37.5 | 0 | .143 | .119 | .151 | .127 | 7.411 | 6.587 |
| 624 | 37.5 | 894 | .101 | .026+ | .109 | .011 | 5.462 | .383 |
| 621 | 52.5 | 0 | .225 | .207 | .239 | .213 | 7.630 | 17.961 |
| 625 | 52.5 | 894 | .149 | .034+ | .160 | .028 | 6.449 | .623 |
| 622 | 75 | 0 | .408 | .491 | .448 | .509 | 4.417 | 14.318 |
| 626 | 75 | 894 | .410 | .243 | .447 | .260 | 4.741 | 6.530 |
| 627 | 75 | 1207 | .366 | .208 | .398 | .229 | 5.306 | 4.601 |
| 638 | 75 | 1518 | .306 | .185 | .336 | .205 | 4.129 | 3.673 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 47

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
LARGE ORIFICE PENDENT STYLE SPRINKLER CENTERED AT
A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 629 | 21 | 0 | .041 | .039 | .044 | .038 | 4.886 | 8.395 |
| 633 | 21 | 894 | .027 | .009+ | .029 | .002 | 4.424 | .353 |
| 630 | 37.5 | 0 | .093 | .099 | .097 | .103 | 9.708 | 13.857 |
| 634 | 37.5 | 894 | .063 | .023+ | .070 | .010 | 4.277 | .393 |
| 631 | 52.5 | 0 | .155 | .224 | .166 | .236 | 6.825 | 10.584 |
| 635 | 52.5 | 894 | .109 | .035+ | .117 | .013 | 6.403 | .367 |
| 632 | 75 | 0 | .257 | .547 | .287 | .566 | 3.070 | 17.871 |
| 636 | 75 | 894 | .277 | .257 | .300 | .270 | 5.036 | 10.258 |
| 637 | 75 | 1207 | .161 | .029+ | .179 | .012 | 3.731 | .376 |

+ - One or more pans with no collected density.



DW1B:pr

TABLE 48

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
RESIDENTIAL TYPE SPRINKLER
CENTERED AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 524 | 15 | 0 | .109 | .218 | .122 | .248 | 1.867 | 4.698 |
| 528 | 15 | 894 | .087+ | .126 | .088 | .143 | 1.071 | 2.026 |
| 529 | 15 | 1207 | .086+ | .097 | .087 | .111 | 1.086 | 1.998 |
| 525 | 28 | 0 | .154 | .344 | .170 | .382 | 3.776 | 3.748 |
| 531 | 28 | 894 | .125 | .156 | .137 | .177 | 4.367 | 2.074 |
| 530 | 28 | 1207 | .118 | .113 | .130 | .128 | 4.507 | 1.968 |
| 526 | 40 | 0 | .159 | .374 | .179 | .386 | 2.433 | 19.014 |
| 532 | 40 | 894 | .146 | .089 | .160 | .095 | 4.358 | 8.058 |
| 533 | 40 | 1207 | .138 | .049 | .153 | .054 | 4.152 | 4.110 |
| 527 | 55 | 0 | .211 | .351 | .240 | .375 | 2.062 | 7.558 |
| 535 | 55 | 894 | .213 | .099 | .238 | .112 | 3.169 | 1.751 |
| 534 | 55 | 1207 | .201 | .061 | .226 | .069 | 2.890 | 1.926 |

\+ - One or more pans with no collected water.



DW1B:pr

TABLE 49

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
RESIDENTIAL TYPE SPRINKLER
CENTERED AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 512 | 15 | 0 | .048+ | .153 | .049 | .173 | 1.158 | 2.628 |
| 516 | 15 | 894 | .041+ | .087 | .042 | .099 | 1.190 | 2.025 |
| 517 | 15 | 1207 | .038+ | .055+,++ | .039 | .042 | 1.210 | .573 |
| 513 | 28 | 0 | .096 | .283 | .105 | .314 | 4.882 | 3.760 |
| 520 | 28 | 894 | .082 | .114 | .091 | .129 | 3.659 | 2.906 |
| 518 | 28 | 1207 | .073 | .069++ | .080 | .079 | 4.711 | 2.383 |
| 514 | 40 | 0 | .130 | .262 | .148 | .268 | 2.206 | 23.153 |
| 519 | 40 | 894 | .105 | .070 | .117 | .078 | 3.851 | 3.830 |
| 521 | 40 | 1207 | .096 | .030+,++ | .107 | .023 | 3.713 | .616 |
| 515 | 55 | 0 | .184 | .395 | .208 | .445 | 1.680 | 2.780 |
| 523 | 55 | 894 | .145 | .069 | .164 | .079 | 2.746 | 1.930 |
| 522 | 55 | 1207 | .126 | .053++ | .141 | .060 | 2.897 | 3.586 |

\+ - One or more pans with no collected density.
++ - Flames at least 3 ft above water collectors.



DW1B:pr

TABLE 50

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
RESIDENTIAL TYPE SPRINKLER
CENTERED AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 500 | 15 | 0 | .035 | .116 | .039 | .127 | 3.190 | 4.772 |
| 504 | 15 | 894 | .032+ | .052 | .034 | .060 | 1.800 | 2.483 |
| 505 | 15 | 1207 | .026+ | .050++ | .027 | .057 | 1.177 | 3.045 |
| 501 | 28 | 0 | .070 | .169 | .077 | .187 | 4.890 | 4.248 |
| 507 | 28 | 894 | .066 | .073 | .073 | .082 | 4.162 | 2.836 |
| 506 | 28 | 1207 | .056 | .047++ | .063 | .063 | 2.904 | 3.833 |
| 502 | 40 | 0 | .117 | .253 | .131 | .274 | 3.142 | 5.713 |
| 508 | 40 | 894 | .083 | .050 | .090 | .056 | 5.910 | 3.608 |
| 509 | 40 | 1207 | .070 | .022+, ++ | .077 | .009 | 4.206 | .395 |
| 503 | 55 | 0 | .196 | .282 | .222 | .303 | 1.987 | 6.661 |
| 511 | 55 | 894 | .149 | .084 | .169 | .094 | 2.291 | 3.398 |
| 510 | 55 | 1207 | .132 | .082++ | .151 | .088 | 2.000 | 7.493 |

\+ - One or more pans with no collected density.
++ - Flames at least 3 ft above water collectors.



DW1B:pr

TABLE 51

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 663 | 30 | 0 | .026+ | .022+ | .004 | .008 | .315 | .390 |
| 667 | 30 | 894 | .033+ | .023+ | .009 | .003 | .341 | .307 |
| 664 | 56 | 0 | .061+ | .119+ | .039 | .088 | .473 | .523 |
| 668 | 56 | 894 | .072+ | .078+ | .071 | .024 | .936 | .327 |
| 665 | 80 | 0 | .089+ | .157 | .060 | .164 | .507 | 1.158 |
| 669 | 80 | 894 | .107+ | .074 | .112 | .083 | 1.224 | 2.370 |
| 666 | 110 | 0 | .098+ | .058+ | .022 | .017 | .314 | .338 |
| 670 | 110 | 894 | .127+ | .040+ | .091 | .012 | .553 | .091 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 52

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 671 | 30 | 0 | .043+ | .076+ | .043 | .060 | 1.009 | .569 |
| 675 | 30 | 894 | .049+ | .039+ | .052 | .032 | 1.571 | .616 |
| 672 | 56 | 0 | .081 | .118 | .091 | .126 | 3.065 | 7.405 |
| 676 | 56 | 894 | .081 | .055 | .088 | .061 | 4.621 | 3.913 |
| 673 | 80 | 0 | .116 | .190 | .131 | .208 | 2.417 | 4.843 |
| 677 | 80 | 894 | .104 | .052+ | .114 | .043 | 4.078 | .617 |
| 674 | 110 | 0 | .133+ | .284 | .088 | .311 | .491 | 1.425 |
| 678 | 110 | 894 | .162 | .103 | .181 | .117 | 1.838 | 2.283 |
| 679 | 110 | 1207 | .170 | .059+ | .192 | .039 | 2.240 | .527 |

+ - One or more pans had no collected density.

TABLE 53

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 680 | 30 | 0 | .048 | .065 | .052 | .068 | 5.878 | 11.300 |
| 681 | 30 | 0 | .047 | .068 | .051 | .071 | 5.246 | 9.802 |
| 685 | 30 | 894 | .048 | .038 | .051 | .041 | 6.918 | 4.532 |
| 684 | 56 | 0 | .066 | .107 | .072 | .129 | 4.509 | 3.587 |
| 686 | 56 | 894 | .067 | .069+ | .073 | .032 | 4.522 | .610 |
| 682 | 80 | 0 | .085 | .113 | .095 | .124 | 3.314 | 4.872 |
| 687 | 80 | 894 | .113 | .059 | .126 | .067 | 3.157 | 2.303 |
| 688 | 80 | 1207 | .111 | .033+ | .123 | .013 | 3.488 | .369 |
| 683 | 110 | 0 | .078+ | .128 | .064 | .129 | .643 | 1.281 |
| 689 | 110 | 894 | .147 | .159 | .166 | .181 | 2.157 | 1.859 |
| 690 | 110 | 1207 | .158 | .096+ | .177 | .061 | 2.647 | .490 |
| 691 | 110 | 1518 | .119 | .052+ | .135 | .016 | 2.063 | .343 |

+ - One or more pans had no collected density.

TABLE 54

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 813 | 30 | 0 | .001+ | .000+ | .000 | .000 | - | - |
| 817 | 30 | 894 | .002+ | .011+ | .000 | .002 | - | .342 |
| 814 | 56 | 0 | .007+ | .010+ | .001 | .002 | .355 | .349 |
| 818 | 56 | 894 | .016+ | .014+ | .003 | .002 | .341 | .329 |
| 815 | 80 | 0 | .008+ | .020+ | .001 | .003 | .349 | .314 |
| 819 | 80 | 894 | .014+ | .031+ | .002 | .003 | .334 | .294 |
| 816 | 110 | 0 | .005+ | .030+ | .001 | .003 | .375 | .294 |
| 820 | 110 | 894 | ++ | ++ | - | - | - | - |
| 821 | 110 | 1207 | .009+ | .037+ | .001 | .003 | .341 | .287 |

\+ - One or more pans had no collected density.

++ - Three of the eight heptane nozzle sets extinguished. Test discontinued.



DW1B:pr

TABLE 55

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 822 | 30 | 0 | .036+ | .016+ | .009 | .007 | .336 | .413 |
| 826 | 30 | 894 | .037+ | .020+ | .012 | .003 | .361 | .313 |
| 823 | 56 | 0 | .069+ | .066+ | .034 | .046 | .405 | .532 |
| 827 | 56 | 894 | .080+ | .064+ | .072 | .018 | .762 | .333 |
| 824 | 80 | 0 | .090+ | .077+ | .039 | .023 | .387 | .327 |
| 828 | 80 | 894 | .076+ | .072+ | .077 | .026 | .684 | .316 |
| 825 | 110 | 0 | .095+ | .065+ | .032 | .020 | .367 | .334 |
| 829 | 110 | 894 | .076+ | .072+ | .022 | .019 | .349 | .328 |

+ - One or more pans had no collected density.

TABLE 56

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS
AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 830 | 30 | 0 | .044+ | .077+ | .044 | .060 | 1.011 | .561 |
| 834 | 30 | 894 | .043 | .042+ | .043 | .015 | 1.011 | .357 |
| 835 | 30 | 1207 | .047+ | .041+ | .048 | .031 | 1.112 | .584 |
| 831 | 56 | 0 | .083 | .133 | .094 | .149 | 2.174 | 3.087 |
| 836 | 56 | 894 | .100 | .084 | .111 | .096 | 3.551 | 2.555 |
| 837 | 56 | 1207 | .100 | .051+ | .110 | .040 | 4.239 | .588 |
| 832 | 80 | 0 | .110 | .156 | .124 | .175 | 1.793 | 3.286 |
| 838 | 80 | 894 | .141 | .147 | .159 | .164 | 1.981 | 1.575 |
| 839 | 80 | 1207 | .139 | .063+ | .157 | .019 | 2.070 | .336 |
| 833 | 110 | 0 | .121+ | .177 | .114 | .200 | .835 | 1.996 |
| 841 | 110 | 894 | ++ | ++ | - | - | - | - |
| 840 | 110 | 1207 | .148+ | .169 | .132 | .170 | .747 | 1.007 |

\+ - One or more pans had no collected density.
++ - Three of the eight heptane nozzles extinguished. Test discontinued.



DW1B:pr

TABLE 57

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 692 | 42 | 0 | .023+ | .013+ | .003 | .002 | .310 | .334 |
| 696 | 42 | 894 | .029+ | .017+ | .005 | .002 | .326 | .321 |
| 693 | 75 | 0 | .052+ | .051+ | .020 | .017 | .374 | .347 |
| 697 | 75 | 894 | .066+ | .034+ | .041 | .003 | .468 | .290 |
| 694 | 105 | 0 | .063+ | .060+ | .016 | .046 | .333 | .571 |
| 698 | 105 | 894 | .074+ | .044+ | .033 | .013 | .397 | .348 |
| 695 | 150 | 0 | .049+ | .044+ | .018 | .025 | .436 | .543 |
| 699 | 150 | 894 | .049+ | .022+ | .007 | .003 | .325 | .308 |
| 700 | 150 | 1207 | .051+ | .019+ | .008 | .003 | .323 | .314 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 58

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 701 | 42 | 0 | .043+ | .040+ | .023 | .014 | .429 | .359 |
| 705 | 42 | 894 | .052+ | .046+ | .041 | .016 | .588 | .352 |
| 702 | 75 | 0 | .085+ | .128 | .081 | .144 | .866 | 2.491 |
| 706 | 75 | 894 | .102 | .098 | .116 | .111 | 2.662 | 2.410 |
| 707 | 75 | 1207 | .103 | .070 | .115 | .078 | 2.863 | 3.531 |
| 703 | 105 | 0 | .126+ | .173 | .125 | .195 | .978 | 2.165 |
| 708 | 105 | 894 | .126 | .081+ | .139 | .063 | 1.483 | .557 |
| 709 | 105 | 1207 | .129 | .071+ | .144 | .054 | 1.673 | .565 |
| 710 | 105 | 1518 | .128 | .038+ | .144 | .013 | 1.922 | .360 |
| 704 | 150 | 0 | .159+ | .172+ | .069 | .106 | .389 | .466 |
| 711 | 150 | 894 | ++ | ++ | - | - | - | - |
| 712 | 150 | 1207 | .017+ | .012+ | .051 | .002 | .404 | .336 |

\+ - One or more pans had no collected density.
++ - Three of the eight heptane nozzle sets extinguished. Test discontinued.



DW1B:pr

TABLE 59

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 713 | 42 | 0 | .062 | .122 | .068 | .125 | 4.395 | 7.278 |
| 717 | 42 | 894 | .067 | .074 | .072 | .078 | 5.559 | 9.146 |
| 718 | 42 | 1207 | .066 | .040+ | .071 | .033 | 5.560 | .632 |
| 714 | 75 | 0 | .102 | .155 | .112 | .171 | 5.029 | 4.511 |
| 719 | 75 | 894 | .105 | .090 | .114 | .101 | 5.934 | 3.522 |
| 720 | 75 | 1207 | .100 | .093 | .108 | .096 | 6.365 | 17.007 |
| 715 | 105 | 0 | .169 | .271 | .187 | .301 | 3.892 | 3.898 |
| 721 | 105 | 894 | .153 | .139 | .164 | .155 | 7.286 | 2.719 |
| 722 | 105 | 1207 | .141 | .077 | .150 | .087 | 9.132 | 2.062 |
| 716 | 150 | 0 | .236 | .364 | .264 | .413 | 1.670 | 1.932 |
| 723 | 150 | 894 | ++ | ++ | - | - | - | - |
| 724 | 150 | 1207 | .255 | .238 | .286 | .270 | 3.076 | 2.371 |
| 725 | 150 | 1518 | .205 | .140 | .231 | .153 | 2.797 | 1.339 |

\+ - One or more pans had no collected density.
++ - Three of the eight heptane nozzle sets extinguished. Test discontinued.



DW1B:pr

TABLE 60

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 552 | 30 | 0 | .012+ | .007+ | .001 | .002 | .330 | .369 |
| 556 | 30 | 894 | .016+ | .008+ | .003 | .002 | .337 | .364 |
| 553 | 56 | 0 | .054+ | .065 | .053 | .074 | .936 | 2.277 |
| 557 | 56 | 894 | .059 | .039+ | .067 | .031 | 1.991 | .604 |
| 554 | 80 | 0 | .095 | .122 | .107 | .131 | 3.092 | 6.416 |
| 558 | 80 | 894 | .087 | .042 | .096 | .047 | 3.555 | 2.501 |
| 555 | 110 | 0 | .132 | .242 | .149 | .271 | 1.956 | 3.136 |
| 559 | 110 | 894 | .122 | .067+ | .139 | .044 | 2.206 | .514 |

+ - One or more pans had no collected density.

TABLE 61

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 540 | 30 | 0 | .029+ | .026+ | .017 | .010 | .461 | .382 |
| 544 | 30 | 894 | .032+ | .037+ | .019 | .013 | .462 | .362 |
| 541 | 56 | 0 | .061 | .079 | .069 | .086 | 2.423 | 4.970 |
| 545 | 56 | 894 | .060 | .050 | .067 | .050 | 2.657 | 2.868 |
| 542 | 80 | 0 | .080 | .110 | .090 | .120 | 2.859 | 5.125 |
| 546 | 80 | 894 | .068 | .042 | .077 | .049 | 2.395 | 1.763 |
| 543 | 110 | 0 | .128 | .204 | .145 | .228 | 2.069 | 3.096 |
| 547 | 110 | 894 | .115 | .081+ | .130 | .053 | 2.014 | .507 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 62

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS ON THE
SAME BRANCHLINE AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 536 | 30 | 0 | .038 | .053 | .042 | .058 | 3.421 | 5.942 |
| 548 | 30 | 894 | .040 | .046+ | .045 | .040 | 2.314 | .636 |
| 537 | 56 | 0 | .055 | .074 | .061 | .080 | 3.246 | 5.416 |
| 549 | 56 | 894 | .062 | .040 | .070 | .044 | 2.843 | 2.789 |
| 538 | 80 | 0 | .072 | .120 | .081 | .134 | 2.968 | 3.034 |
| 550 | 80 | 894 | .077 | .053+ | .087 | .017 | 2.430 | .344 |
| 539 | 110 | 0 | .134 | .216 | .152 | .237 | 2.037 | 4.604 |
| 551 | 110 | 894 | .077+ | .111+ | .071 | .075 | .815 | .505 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 63

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 758 | 30 | 0 | .044+ | .059 | .023 | .063 | .429 | 7.580 |
| 766 | 30 | 894 | .036+ | .036+ | .017 | .031 | .398 | .660 |
| 759 | 56 | 0 | .085+ | .139 | .081 | .152 | .850 | 5.441 |
| 767 | 56 | 894 | .081 | .074 | .091 | .082 | 3.072 | 4.255 |
| 768 | 56 | 1207 | .083 | .059 | .093 | .067 | 3.287 | 1.827 |
| 760 | 80 | 0 | .090+ | .138 | .083 | .150 | .793 | 5.248 |
| 769 | 80 | 894 | .120 | .073 | .135 | .080 | 2.591 | 4.820 |
| 770 | 80 | 1207 | .118 | .058 | .133 | .065 | 2.778 | 3.564 |
| 761 | 110 | 0 | .093+ | .047+ | .022 | .037 | .317 | .595 |
| 771 | 110 | 894 | .148+ | .066 | .114 | .074 | .580 | 2.661 |
| 772 | 110 | 1207 | .159+ | .034+ | .142 | .029 | .739 | .648 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 64

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 762 | 30 | 0 | .045+ | .089 | .048 | .101 | 1.976 | 2.428 |
| 773 | 30 | 894 | .050 | .051 | .056 | .057 | 3.272 | 4.002 |
| 763 | 56 | 0 | .086 | .107 | .093 | .116 | 5.593 | 5.313 |
| 774 | 56 | 894 | .078 | .049+ | .084 | .032 | 5.660 | .656 |
| 764 | 80 | 0 | .124 | .158 | .136 | .171 | 4.847 | 5.507 |
| 775 | 80 | 894 | .113 | .043+ | .124 | .036 | 4.328 | .628 |
| 776 | 80 | 1207 | .111 | .037+ | .121 | .031 | 4.816 | .644 |
| 765 | 110 | 0 | .163+ | .205 | .168 | .228 | 1.122 | 3.731 |
| 777 | 110 | 894 | .175 | .061 | .198 | .069 | 2.381 | 2.546 |
| 778 | 110 | 1207 | .166 | .040 | .188 | .044 | 2.390 | 5.035 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 65

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 779 | 30 | 0 | .050 | .065 | .054 | .069 | 5.433 | 9.625 |
| 783 | 30 | 894 | .048 | .023+ | .052 | .021 | 5.141 | .691 |
| 780 | 56 | 0 | .073 | .082 | .078 | .087 | 7.111 | 9.015 |
| 784 | 56 | 894 | .069 | .038+ | .113 | .095 | 5.347 | 4.640 |
| 781 | 80 | 0 | .109 | .110 | .118 | .117 | 5.009 | 7.633 |
| 785 | 80 | 894 | .104 | .055 | .113 | .067 | 5.347 | 3.369 |
| 782 | 110 | 0 | .170 | .199 | .190 | .219 | 3.250 | 4.428 |
| 786 | 110 | 894 | .142 | .052+ | .161 | .043 | 2.583 | .611 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 66

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 787 | 30 | 0 | .000+ | .000+ | .000 | .000 | - | - |
| 791 | 30 | 894 | .000+ | .010+ | .000 | .005 | - | .523 |
| 788 | 56 | 0 | .002+ | .005+ | .000 | .001 | - | .402 |
| 792 | 56 | 894 | .005+ | .010+ | .000 | .002 | - | .349 |
| 789 | 80 | 0 | .003+ | .005+ | .000 | .001 | - | .394 |
| 793 | 80 | 894 | .007+ | .020+ | .001 | .009 | .365 | .400 |
| 790 | 110 | 0 | .002+ | .000+ | .000 | .000 | - | - |
| 794 | 110 | 894 | .003+ | .021+ | .000 | .009 | - | .399 |

+ - One or more pans had no collected density.

TABLE 67

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 795 | 30 | 0 | .015+ | .0+ | .001 | .000 | .322 | - |
| 799 | 30 | 894 | .023+ | .008+ | .005 | .002 | .338 | .364 |
| 796 | 56 | 0 | .039+ | .031+ | .012 | .012 | .358 | .372 |
| 800 | 56 | 894 | .047+ | .037+ | .015 | .013 | .350 | .363 |
| 797 | 80 | 0 | .045+ | .038+ | .013 | .013 | .350 | .362 |
| 801 | 80 | 894 | .055+ | .046+ | .016 | .016 | .341 | .351 |
| 798 | 110 | 0 | .034+ | .019+ | .004 | .008 | .305 | .402 |
| 802 | 110 | 894 | .037+ | .036+ | .008 | .029 | .334 | .613 |

+ - One or more pans had no collected density.



DW1B:pr

TABLE 68

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 STANDARD ORIFICE UPRIGHT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 803 | 30 | 0 | .039+ | 0.061 | .027 | .066 | .512 | 5.868 |
| 807 | 30 | 894 | .042+ | 0.025 | .042 | .010 | 1.005 | .386 |
| 804 | 56 | 0 | .074 | 0.086 | .084 | .092 | 2.311 | 6.772 |
| 808 | 56 | 894 | .086 | 0.064 | .096 | .072 | 3.364 | 2.908 |
| 805 | 80 | 0 | .101 | 0.094 | .113 | .103 | 1.613 | 4.283 |
| 809 | 80 | 894 | .113 | 0.086 | .127 | .097 | 1.896 | 2.564 |
| 810 | 80 | 1207 | .115 | 0.057+ | .131 | .045 | 2.138 | .582 |
| 806 | 110 | 0 | .092+ | 0.057 | .071 | .064 | .650 | 2.077 |
| 811 | 110 | 894 | ++ | ++ | - | - | - | - |
| 812 | 110 | 1207 | .100+ | 0.041 | .078 | .015 | .652 | .358 |

\+ - One or more pans had no collected density.
++ - Three of the eight heptane nozzle sets extinguished. Test discontinued.



DW1B:pr

TABLE 69

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 726 | 42 | 0 | .024+ | .000+ | .005 | .000 | .335 | - |
| 730 | 42 | 894 | .037+ | .028+ | .012 | .024 | .360 | .690 |
| 727 | 75 | 0 | .062+ | .046 | .037 | .051 | .463 | 3.946 |
| 731 | 75 | 894 | .072+ | .045+ | .069 | .038 | .869 | .640 |
| 728 | 105 | 0 | .084+ | .070 | .052 | .077 | .496 | 3.749 |
| 732 | 105 | 894 | .097+ | .027+ | .086 | .024 | .756 | .674 |
| 729 | 150 | 0 | .066+ | .024+ | .011 | .021 | .310 | .687 |
| 733 | 150 | 894 | .074+ | .025+ | .015 | .021 | .324 | .684 |

+ - One or more pans had no collected density.

TABLE 70

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 734 | 42 | 0 | .056+ | .068 | .056 | .073 | 1.054 | 6.041 |
| 737 | 42 | 894 | .060 | .055 | .067 | .057 | 3.028 | 13.895 |
| 735 | 75 | 0 | .100 | .123 | .111 | .130 | 3.258 | 9.117 |
| 739 | 75 | 894 | .100 | .079 | .110 | .089 | 4.432 | 2.647 |
| 740 | 75 | 1207 | .099 | .066 | .108 | .074 | 4.435 | 2.592 |
| 736 | 105 | 0 | .143 | .123 | .161 | .134 | 2.430 | 6.637 |
| 741 | 105 | 894 | .131 | .072 | .148 | .074 | 2.885 | 24.175 |
| 742 | 105 | 1207 | .126 | .047 | .141 | .057 | 3.345 | 7.526 |
| 738 | 150 | 0 | .178+ | .051 | .149 | .057 | .678 | 3.582 |
| 743 | 150 | 894 | ++ | ++ | - | - | - | - |
| 744 | 150 | 1207 | .160+ | .000+ | .149 | .000 | .809 | 5.918 |

\+ - One or more pans had no collected density.
++ - Three of the eight heptane nozzle sets extinguished. Test discontinued.



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TABLE 71

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 LARGE ORIFICE PENDENT STYLE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 745 | 42 | 0 | .065 | .102 | .070 | .110 | 5.363 | 5.730 |
| 750 | 42 | 894 | .060 | .075 | .065 | .082 | 5.458 | 4.770 |
| 751 | 42 | 1207 | .059 | .044+ | .064 | .036 | 5.721 | .612 |
| 749 | 75 | 0 | .103 | .127 | .109 | .132 | 7.392 | 12.643 |
| 752 | 75 | 894 | .091 | .058+ | .098 | .047 | 6.204 | .602 |
| 753 | 75 | 1207 | .087 | .055+ | .093 | .045 | 6.508 | .602 |
| 747 | 105 | 0 | .129 | .134 | .141 | .146 | 4.633 | 5.615 |
| 754 | 105 | 894 | .113 | .055 | .123 | .062 | 4.656 | 2.697 |
| 755 | 105 | 1207 | .113 | .056 | .123 | .061 | 4.757 | 5.332 |
| 748 | 150 | 0 | .167 | .095 | .188 | .101 | 2.819 | 7.020 |
| 756 | 150 | 894 | .108 | .036+ | .122 | .031 | 1.750 | .661 |
| 757 | 150 | 1207 | .096 | .020+ | .107 | .018 | 1.496 | .726 |

+ - One or more pans had no collected density.



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TABLE 72

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 1 METER

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 560 | 30 | 0 | .031+ | .064 | .009 | .072 | .343 | 2.777 |
| 564 | 30 | 894 | .019+ | .010+ | .005 | .002 | .347 | .349 |
| 561 | 56 | 0 | .066 | .072 | .072 | .081 | 2.257 | 3.039 |
| 565 | 56 | 894 | .060 | .049 | .068 | .054 | 2.745 | 4.241 |
| 562 | 80 | 0 | .096 | .124 | .104 | .132 | 5.350 | 8.316 |
| 566 | 80 | 894 | .094 | .050 | .102 | .055 | 5.245 | 5.092 |
| 563 | 110 | 0 | .128 | .195 | .142 | .204 | 3.936 | 12.281 |
| 567 | 110 | 894 | .124 | .088 | .136 | .096 | 4.013 | 6.975 |
| 568 | 110 | 1207 | .122 | .044 | .134 | .049 | 4.198 | 3.443 |

+ - One or more pans had no collected density.

TABLE 73

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 2 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 569 | 30 | 0 | .035+ | .052 | .033 | .054 | .817 | 16.367 |
| 573 | 30 | 894 | .037+ | .045 | .040 | .049 | 1.523 | 5.206 |
| 570 | 56 | 0 | .075 | .100 | .084 | .107 | 2.920 | 8.162 |
| 574 | 56 | 894 | .067 | .051 | .074 | .053 | 3.974 | 11.347 |
| 571 | 80 | 0 | .086 | .112 | .096 | .119 | 2.900 | 8.792 |
| 575 | 80 | 894 | .079 | .063 | .089 | .070 | 2.787 | 4.495 |
| 572 | 110 | 0 | .121 | .194 | .135 | .203 | 3.111 | 10.965 |
| 576 | 110 | 894 | .120 | .112 | .133 | .118 | 3.583 | 8.935 |
| 577 | 110 | 1207 | .125 | .032 | .140 | .034 | 3.402 | 7.339 |

+ - One or more pans had no collected density.

TABLE 74

SIMULATED PLASTIC COMMODITY ADD CONFIGURATION
2 RESIDENTIAL TYPE SPRINKLERS
POSITIONED DIAGONALLY AT A CLEARANCE OF 4 METERS

| TEST NO. | WATER FLOW RATE, GPM | RATE OF HEAT RELEASE, KW | COLLECTED DENSITY, GPM/FT² | | CHARACTERISTIC ADD, GPM/FT² | | UNIFORMITY VALUE | |
|---|---|---|---|---|---|---|---|---|
| | | | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 | PANS 1-16 | PANS 17-20 |
| 578 | 30 | 0 | .042 | .063 | .044 | .068 | 7.119 | 6.911 |
| 582 | 30 | 894 | .039 | .036+ | .044 | .032 | 3.859 | .661 |
| 579 | 56 | 0 | .063 | .096 | .071 | .104 | 3.419 | 6.440 |
| 583 | 56 | 894 | .058 | .043 | .065 | .046 | 3.469 | 7.631 |
| 580 | 80 | 0 | .088 | .135 | .700 | .144 | 2.651 | 8.434 |
| 584 | 80 | 894 | .099 | .040 | .110 | .042 | 4.107 | 6.393 |
| 581 | 110 | 0 | .144 | .208 | .161 | .216 | 3.091 | 12.640 |
| 585 | 110 | 894 | .119 | .063 | .132 | .071 | 3.437 | 2.507 |

+ - One or more pans had no collected density.

# D I S C U S S I O N  O F  A D D  V A L U E S

DATA ANALYSIS:

The data collected from each ADD test was analyzed to determine the collected densities, the characteristic ADD's and uniformity values.

For the upholstered furniture ADD configuration tests, these values were determined both for Pans 1 through 16, which represented one quadrant of the sprinkler spacing area, and also for Pans 16 through 19 which were located in the center of the configuration directly below the heptane nozzle manifold.

For the simulated plastic commodity ADD configuration, these values were determined for Pans 1 through 16 which were positioned inside of the four water collection containers and for Pans 17 through 20 which were located in the flue space directly below the heptane nozzle manifold.

The collected density values were calculated by summing the collected density in each water collector and dividing by the number of water collectors. These values are the arithmetic mean collected densities in gallons per minute per square foot.

The characteristic ADD and uniformity values were calculated using a maximum likelihood function for a sample of independent observations. The equation for the characteristic ADD and uniformity values are as follows:

$$\text{Characteristic ADD} = \left[ \frac{1}{n} \sum_{i=1}^{n} X_i^b \right]^{1/b} \quad \text{and}$$

$$\text{Uniformity value} = \frac{\sum_{i=1}^{n} X_i^b}{\sum_{i=1}^{n} X_i^b \ln X_i - \left[ \sum_{i=1}^{n} X_i^b \right] \left[ \frac{1}{n} \sum_{i=1}^{n} \ln X_i \right]}$$

where b = uniformity value
x = individual water collector density
n = number of water collectors

In general, the higher the uniformity value (i.e., greater than one) the more uniform the distribution and the higher the value of the characteristic ADD. Conversely, the lower the uniformity value (i.e., less than one) the less uniform the distribution and the lower the value of the characteristic ADD. Thus, while two sprinklers may have the same collected densities, the sprinkler with the more uniform distribution and a larger uniformity value will have a higher characteristic ADD value.

UPHOLSTERED FURNITURE ADD RESULTS:

The results of the upholstered furniture ADD tests are contained in Tables 2 through 38. For tests with a single sprinkler centered (Tables 2 through 13), the highest characteristic ADD values were obtained at a deflector to top of water collector clearance of 1 m except for the standard orifice upright style sprinkler, which had its highest characteristic ADD values at a clearance of 2 m.

With two sprinklers positioned on the same branch line (Tables 14 through 26), the highest characteristic ADD values were obtained at clearances of 1 m for the standard orifice pendent and residential sprinklers, 2 m for the large orifice pendent sprinkler and 4 m for the upright style sprinkler.

For two sprinklers located diagonally (Tables 27 through 38), the highest characteristic ADD values were obtained at a clearance of 1 m for the standard orifice pendent style and 2 m for the other three styles of sprinklers.

For the upholstered furniture ADD tests, the most uniform distribution values were obtained with the sprinkler positioned at a 4 m clearance from the deflector to the top of the water collectors. See Table 75.

Table 75

Effects Of Sprinkler Position And Clearance On The Characteristic ADD And Uniformity Value For The Upholstered Furniture ADD Configuration

| Sprinkler Location | No. of Sprinklers | Sprinkler Type | Clearance from Deflector to Top of Water Collector, m | |
|---|---|---|---|---|
| | | | Highest Characteristic ADD | Highest Uniformity Value |
| Centered | 1 | SSP | 1 | 4 |
| Centered | 1 | SSU | 2 | 4 |
| Centered | 1 | L/O | 1 | 4 |
| Centered | 1 | RES | 1 | 4 |
| Branchline | 2 | SSP | 1 | 4 |
| Branchline | 2 | SSU | 4 | 4 |
| Branchline | 2 | L/O | 2 | 4 |
| Branchline | 2 | RES | 1 | 4 |
| Diagonal | 2 | SSP | 1 | 4 |
| Diagonal | 2 | SSU | 2 | 4 |
| Diagonal | 2 | L/O | 2 | 4 |
| Diagonal | 2 | RES | 1 | 4 |

SIMULATED PLASTIC COMMODITY ADD RESULTS:

The results of the simulated plastic commodity ADD tests are contained in Tables 39 through 74. For tests with a single sprinkler centered (Tables 39 through 50), the highest characteristic ADD values were obtained at a deflector to top of water collector clearance of 1 m.

With two sprinklers positioned on the same branch line (Tables 51 through 62), the highest characteristic ADD values were obtained at clearances of 2 m for the standard orifice pendent style sprinkler and at 4 m for the other three styles of sprinklers.

For two sprinklers located diagonally (Tables 63 through 74), the highest characteristic ADD values were obtained at a clearance of 2 m for the standard orifice pendent style sprinkler and at 4 m for the other three styles of sprinklers.

For the simulated plastic commodity ADD tests, the most uniform distribution values were obtained with the sprinkler positioned at a clearance of 1 m for the standard orifice pendent style, upright style and residential sprinklers centered, at a clearance of 2 m for two residential sprinklers located on the same branch line and at 4 m for the other combinations of sprinkler styles and sprinkler positions. See Table 76.

Table 76

Effects Of Sprinkler Position And Clearance On The Characteristic ADD And Uniformity Value For The Simulated Plastic Commodity ADD Configuration

| Sprinkler Location | No. of Sprinklers | Sprinkler Type | Clearance from Deflector to Top of Water Collector, m | |
|---|---|---|---|---|
| | | | Highest Characteristic ADD | Highest Uniformity Value |
| Centered | 1 | SSP | 1 | 1 |
| Centered | 1 | SSU | 1 | 1 |
| Centered | 1 | L/O | 1 | 4 |
| Centered | 1 | RES | 1 | 1 |
| Branchline | 2 | SSP | 2 | 4 |
| Branchline | 2 | SSU | 4 | 4 |
| Branchline | 2 | L/O | 4 | 4 |
| Branchline | 2 | RES | 4 | 4 |
| Diagonal | 2 | SSP | 2 | 4 |
| Diagonal | 2 | SSU | 4 | 4 |
| Diagonal | 2 | L/O | 4 | 4 |
| Diagonal | 2 | RES | 4 | 2 |

RECOMMENDATIONS:

A data analysis of the interrelationship between the test variables which include sprinkler locations, positions, deflector to top of water collector clearances, rates of heat release, orifice size and style of sprinkler needs to be conducted.

If additional ADD tests are to be conducted, the following variables should be considered:

(1) Sprinklers fabricated by additional manufacturers should be utilized.

(2) Multiple flowing sprinklers should be utilized.

(3) Additional sprinkler spacings as specified in the Standard for the Installation of Sprinkler Systems, NFPA 13, should be utilized.

(4) The effect of varying the clearance between the deflector and the top of water collectors needs to be determined.

(5) A method needs to be established for the development of performance curves for each manufacturer's sprinkler. These curves could be a graphical presentation of ADD versus rate of heat release at various flowing pressures.



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