

## CHAPTER III SYSTEM DESIGN

This section will cover the proper design of the Pyro-Chem Kitchen Knight II Restaurant Fire Suppression System. It is divided into three (3) sections:

- Nozzle Coverage and Placement
- Piping Limitations
- Detector Requirements

Each of these sections must be completed before attempting any installation.

### NOZZLE COVERAGE AND PLACEMENT

This section will provide guidelines for determining nozzle type, positioning, and quantity for duct, plenum, and appliance protection.

#### A. Duct Protection

It is not required that the fan be shut down or the exhaust duct be dampered for the system to operate properly. Each nozzle is approved to protect exhaust ducts of unlimited length.

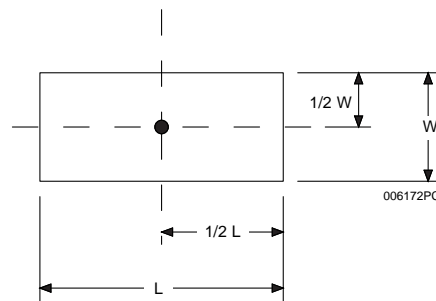
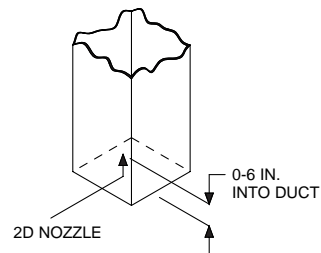
Duct protection requires that a nozzle be positioned to discharge up, into the duct. The nozzle is a Model 2D, Part No. 551038.

- The Model 2D duct nozzle is a two (2) flow nozzle. A single 2D nozzle is capable of protecting square or rectangular
- ▶ duct with a maximum of 100 in. (254 cm) perimeter, with the
  - ▶ longest side being a maximum of 34 in. (86.4 cm). It can also protect a round duct with a maximum diameter of
  - ▶ 31 7/8 in. (81 cm).

- Two (2) Model 2D duct nozzles can protect a square or
- ▶ rectangular duct with a maximum of 150 in. (381 cm) perimeter, with the longest side being a maximum of 51 in. (129.5 cm). They can also protect a round duct with a maximum diameter of 47 1/2 in. (120.7 cm).

When two (2) 2D duct nozzles are used to protect a single duct, the cross sectional area of the duct must be divided into two equal symmetrical areas. The nozzle must then be installed on the centerline of the area it protects and aimed directly into the duct opening.

- The nozzle(s) must be installed on the centerline of the duct,
- ▶ with the tip located 0 to 6 in. (15.2 cm) into the opening, and aimed directly into the duct opening. See **Figure 3-1**.

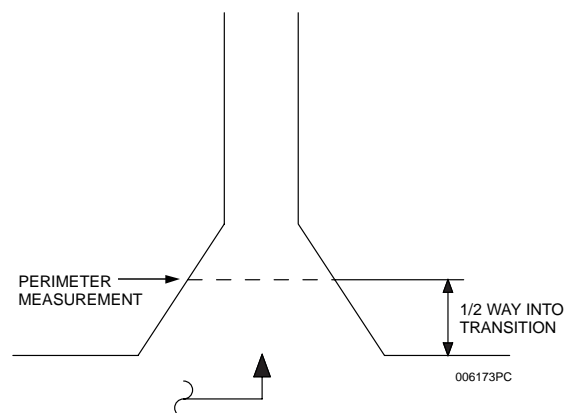


**Figure 3-1.**

**Transition Ducts** – The protection of non-standard ducts should be reviewed by the authority having jurisdiction. Pyro-Chem Kitchen Knight II recommends that transition ducts be protected as follows:

- Transition ducts – larger to smaller

In cases where the duct/plenum interface opening is larger than the final exhaust duct, measure the perimeter/diameter of the duct halfway between the largest and smallest section (or the average perimeter/diameter). The nozzle is to be located within 0-6 in. (15.2 cm) of the duct/plenum interface (not at the point where the measurement was taken), centered under the final exhaust duct opening. See **Figure 3-1a**.



**Figure 3-1a.**

b. Transition ducts – smaller to larger

In cases where the duct/plenum interface opening is smaller than the final exhaust duct, measure the perimeter/diameter of the final exhaust duct. The nozzle(s) is to be located within 0-6 in. (15.2 cm) of the duct/plenum interface, centered in the opening. See Figure 3-1b.

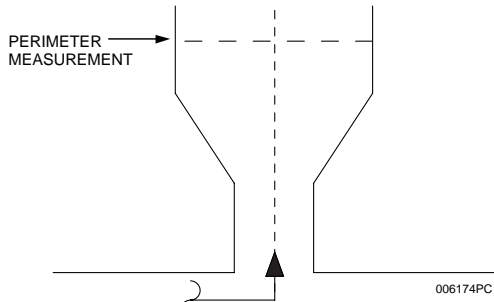


Figure 3-1b

c. Multiple risers

In cases of multiple rises, each riser is protected as an individual duct. See Figure 3-1c.

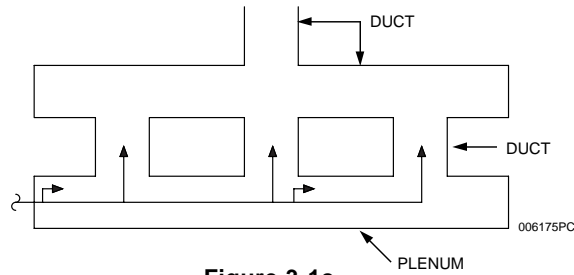


Figure 3-1c

**Electrostatic Precipitator** – Ducts utilizing electrostatic precipitators must be protected above and below the unit. Standard duct nozzles are used in this application. See Figure 3-1d.

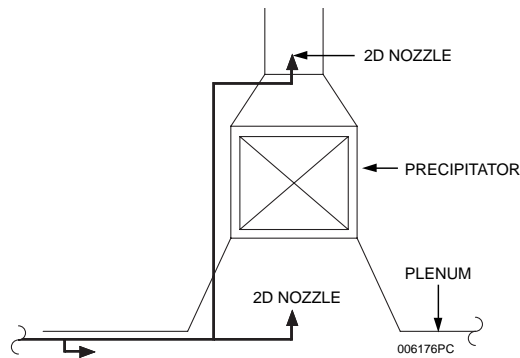


Figure 3-1d

**B. Plenum Protection**

The Model 1H nozzle, Part No. 551029, is a one (1) flow nozzle used for plenum protection. A single 1H nozzle can protect a plenum (with single or V-bank filters) 10 ft. (3.1 m)

- ▶ long by 4 ft. (1.2 m) wide. Dividing the length into sections equal to or less than 10 ft. (3.1 m) in length and positioning a nozzle at the start of each section can be done to protect longer plenums.

On V-bank plenums, the nozzle(s) must be located at the center of the V-bank width, 1/3 of the vertical height of the filters. On single filter bank plenums, the nozzle must be located 2 in. (5.1 cm) from the back edge of the filter, 1/3 down from the vertical height. For either application, the nozzle must be located within 6 in. (15.2 cm) of the end of the plenum (or module) and aimed directly down the length of the plenum. See Figure 3-2.

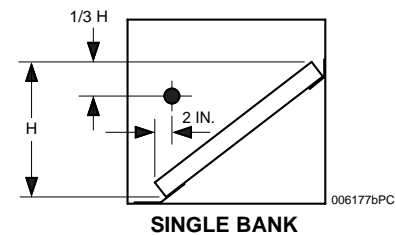
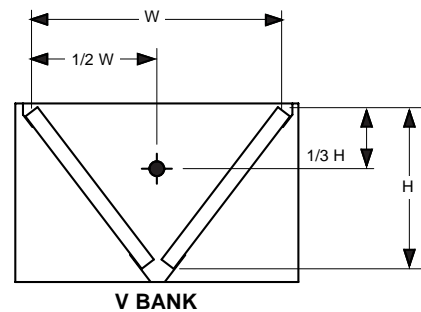
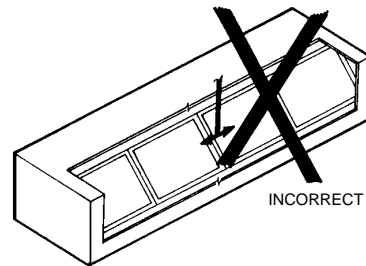
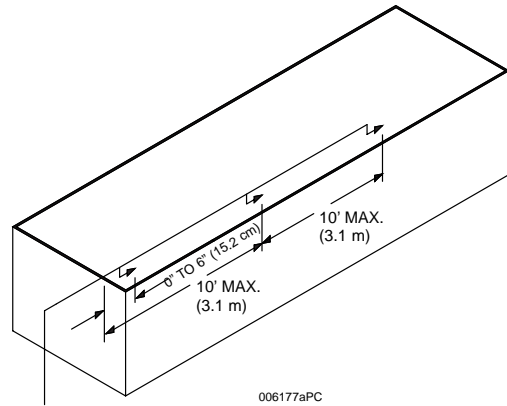


Figure 3-2

### C. Appliance Protection

Note: When protecting appliances which are larger than single nozzle coverage, multiple nozzles can be used.

Larger appliances can be divided into several modules, each equal to or smaller than single nozzle coverage. Exception:

- ▶ Fryers must not exceed a maximum of 864 sq. in. (5574 sq. cm).
- ▶ sq. cm).

For modularizing fryers, refer to "FRYER – MULTIPLE NOZZLE PROTECTION"

#### Design Chart

Appliance Type	Maximum Cooking Hazard Area per Nozzle
▶ Fryer Without Drip Board	19 in. x 19 1/2 in. maximum (48 x 49.5 cm)
Fryer With Drip Board	18 in. x 27 3/4 in. (45.7 x 70.5 cm) maximum; 19 1/2 in. x 25 3/8 in. (49.5 x 64.5 cm) maximum
Small Range	12 in. x 28 in. (30.5 x 71.1 cm) maximum
Large Range	28 in. x 28 in. (71.1 x 71.1 cm) maximum
Small Wok	24 in. diameter x 6 in. deep (61 x 15.2 cm) maximum
Large Wok	30 in. diameter x 8 in. deep (76.2 x 20.3 cm) maximum
Small Griddle	Maximum area of 1080 sq. in. (6968 sq. cm) with the longest side to be a maximum of 36 in. (91.4 cm)
Large Griddle	Maximum area of 1440 sq. in. (9290 sq. cm) with the longest side to be a maximum of 48 in. (122 cm)
Gas Radiant Char-Broiler	Maximum area of 624 sq. in. (4025.8 sq. cm) with the longest side to be a maximum of 26 in. (66 cm)
Gas Radiant Char-Broiler	Maximum area of 864 sq. in. (5574 sq. cm) with the longest side to be a maximum of 36 in. (91.4 cm)
Lava Rock Char-Broiler	Maximum area of 624 sq. in. (4025.8 sq. cm) with the longest side to be a maximum of 26 in. (66 cm)
Natural Charcoal Broiler	Maximum area of 480 sq. in. (3096.8 sq. cm) with the longest side to be a maximum of 24 in. (61 cm)
Mesquite Char-Broiler	Maximum area of 480 sq. in. (3096.8 sq. cm) with the longest side to be a maximum of 24 in. (61 cm)
Upright/Salamander Broiler	Maximum area of 1064 sq. in. (6865 sq. cm) with the longest side to be a maximum of 36 in. (91 cm)
Chain Broiler	Maximum area of 1026 sq. in. (6619 sq. cm) with the longest side to be a maximum of 38 in. (97 cm)

#### 1a. Fryers without Drip Board (19 in. x 19 1/2 in. maximum) (48 x 49.5 cm)

- ▶ Two nozzles are available for fryer protection: High proximity and low proximity.

The Model 2H nozzle, Part No. 551028, is used for high proximity fryer protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere within the perimeter** of the hazard area, 24 in. to 48 in. (61 to 122 cm) above the cooking surface of the appliance and aimed at the center of the cooking area. See **Figure 3-3a**.

- ▶
- ▶

The Model 2L nozzle is used for low proximity fryer protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the hazard area, 13 in. to 24 in. (33 to 61 cm) above the cooking surface of the appliance and aimed at the center of the cooking area. See **Figure 3-3a**.

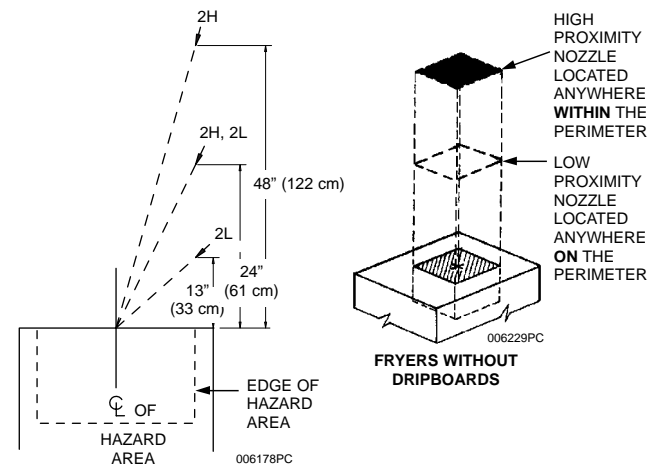


Figure 3-3a

#### 1b. Fryers with Drip Board

The maximum single nozzle protection dimensions depend on the dimensions of the fry pot only.

For fry pots with maximum dimensions of 18 in. (45.7 cm) on the longest side and 324 sq. in. (2090 sq. cm) max. area, use **overall** dimensions of 27 3/4 in. (70.5 cm) on the longest side and 500 sq. in. (3226 sq. cm) max. area.

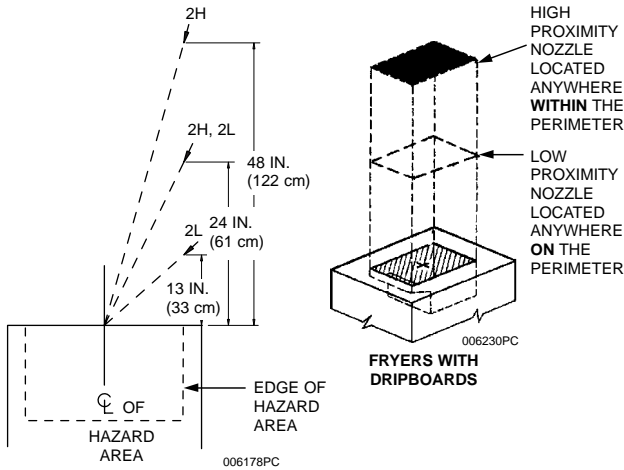
For fry pots with maximum dimensions exceeding 18 in. x 324 sq. in. (2090 sq. cm), but no greater than 19 1/2 in. (49.5 cm) on the longest side and 371 sq. in. (2394 sq. cm) max area, use **overall** dimensions of 25 3/8 in. (64.5 cm) on the longest side and 495 sq. in. (3194 sq. cm) area.

- ▶ Two nozzles are available for fryer protection: High proximity and low proximity.

The Model 2H nozzle, Part No. 551028, is used for high proximity fryer protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere within the perimeter** of the hazard area, 24 in. to 48 in. (61 to 122 cm) above the cooking surface of the appliance and aimed at the center of the cooking area. See **Figure 3-3b**.

- ▶
- ▶

The Model 2L nozzle is used for low proximity fryer protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the hazard area, 13 in. to 24 in. (33 to 61 cm) above the cooking surface of the appliance and aimed at the center of the cooking area. See **Figure 3-3b**.



**Figure 3-3b**

▶ **2. Small Range** (12 in. x 28 in. (30.5 x 71 cm) maximum)

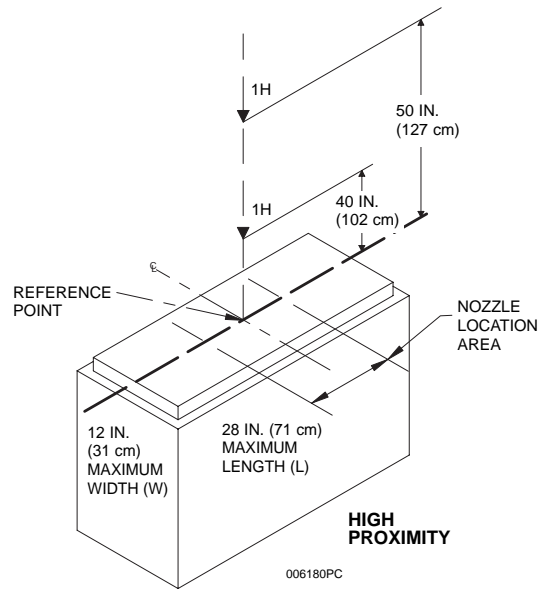
▶ Two nozzles are available for small range protection: High proximity and low proximity.

The Model 1H nozzle, Part No. 551029, is used for high proximity small range protection. This nozzle is a one (1) flow nozzle. **When using high proximity protection, the range cannot be under a backshelf.** This nozzle must be located on the front/back centerline of the appliance, 40 in. to 50 in. (102 to 127 cm) above the cooking surface, and aimed directly down within the "Nozzle Location Area" depending on the size of the hazard area. See "Nozzle Placement" chart below. See **Figure 3-4a**.

**NOZZLE PLACEMENT CHART**

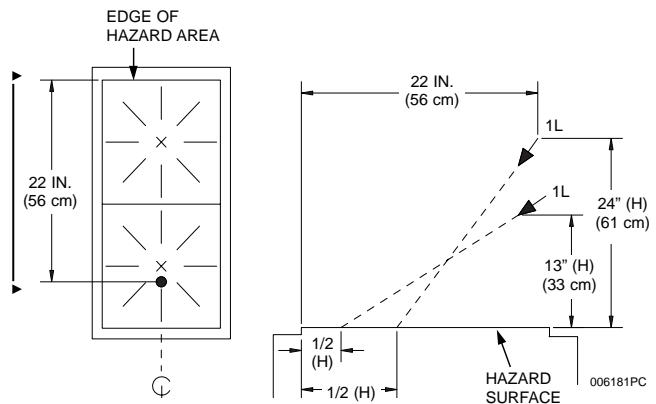
Length – L		Width – W		Front/Rear	
in.	(cm)	in.	(cm)	in.*	(cm)*
12	(31)	12	(31)	8	(20)
13	(33)	12	(31)	7 1/2	(19)
14	(36)	12	(31)	7	(18)
15	(38)	12	(31)	6 1/2	(17)
16	(41)	12	(31)	6	(15)
17	(43)	12	(31)	5 1/2	(14)
18	(45)	12	(31)	5	(13)
19	(48)	12	(31)	4 1/2	(11)
20	(51)	12	(31)	4	(10)
21	(53)	12	(31)	3 1/2	(9)
22	(56)	12	(31)	3	(8)
23	(58)	12	(31)	2 1/2	(6)
24	(61)	12	(31)	2	(5)
25	(64)	12	(31)	1 1/2	(4)
26	(66)	12	(31)	1	(3)
27	(69)	12	(31)	1/2	(1)
28	(71)	12	(31)	0	(0)

\*Distance from centerline, either toward front or toward back, of hazard area, starting from the reference point.



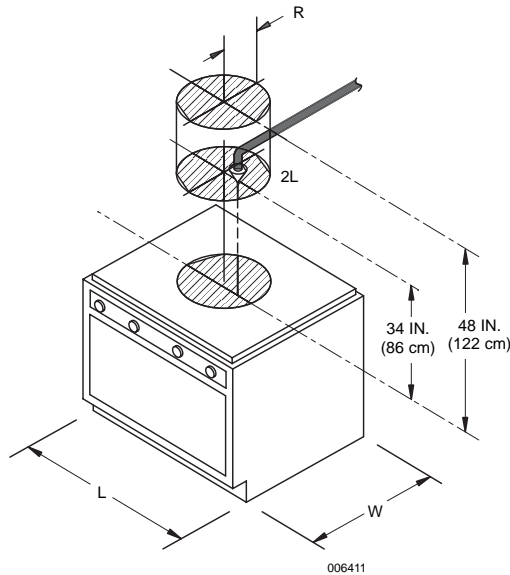
**Figure 3-4a**

The Model 1L nozzle, Part No. 551066, is used for low proximity small range protection. This nozzle is a one (1) flow nozzle. The range can be equipped either with or without a backshelf. Either type requires the same nozzle requirements. The nozzle must be located 22 in. (56 cm) from either end of the hazard area centered from left to right. It must be 13 in. to 24 in. (33 to 61 cm) above cooking surface, and aimed at a point one half the distance of whatever the height dimension of the nozzle is. When determining nozzle and aim point locations, both measurements are to be taken from the **same** end of the hazard area. Example: The nozzle is mounted 20 in. (51 cm) above the cooking surface. The aim point from the edge of the hazard would then be 10 in. (25 cm) which is one half the nozzle mounting height dimension. ▶ See **Figure 3-4b**. Note: Nozzles must be placed at or below the shelf, within the nozzle height limitations.



**Figure 3-4b**

- ▶ **3. Larger Burner Range** (28 in. x 28 in. (71 x 71 cm) maximum)
- ▶ One nozzle is available for large range protection: High proximity.
- ▶ The Model 2L nozzle, Part No. 551027, is used for high proximity large range protection. This nozzle is a two (2) flow nozzle. **When using high proximity protection, the range cannot be under a backshelf.** This nozzle must be located 34 in. to 48 in. (86 to 122 cm) above the cooking surface, and aimed directly down within the mounting area, based on the hazard size, as described in the Nozzle Positioning Chart. See **Figure 3-5**.



**Figure 3-5**

Example: A four burner range has a hazard size of 20 in. (51 cm) in length and 27 in. (69 cm) in width. Follow down the Range Length column in the Nozzle Positioning Chart until you come to 20 in. (51 cm). Continue down this column until the correct width appears in the width column. When the width of 27 in. (69 cm) is arrived at, read across to the radius column to determine the size of radius allowed, for positioning of the nozzle, from the hazard area centerline. In this example, the correct radius is 3 in. (8 cm). The nozzle can be aimed straight down anywhere within a 3 in. (8 cm) radius of the hazard area centerline.

**Nozzle Positioning Chart**

Range Length - L in. (cm)	Range Width - W in. (cm)	Radius - R in. (cm)
18 (46)	18 (46)	7 1/8 (18)
18 (46)	19 (48)	6 3/4 (17)
18 (46)	20 (51)	6 3/8 (16)
18 (46)	21 (53)	6 (15)
18 (46)	22 (56)	5 5/8 (14)
18 (46)	23 (58)	5 1/4 (13)
18 (46)	24 (61)	4 3/4 (12)
18 (46)	25 (64)	4 3/8 (11)
18 (46)	26 (66)	4 (10)

Range Length - L in. (cm)	Range Width - W in. (cm)	Radius - R in. (cm)
18 (46)	27 (69)	3 5/8 (9)
18 (46)	28 (71)	3 1/8 (8)
19 (48)	18 (46)	6 3/4 (17)
19 (48)	19 (48)	6 3/8 (16)
19 (48)	20 (51)	6 (15)
19 (48)	21 (53)	5 5/8 (14)
19 (48)	22 (56)	5 1/4 (13)
19 (48)	23 (58)	4 7/8 (12)
19 (48)	24 (61)	4 1/2 (11)
19 (48)	25 (64)	4 1/8 (10)
19 (48)	26 (66)	3 3/4 (9)
19 (48)	27 (69)	3 1/4 (8)
19 (48)	28 (71)	2 7/8 (7)
20 (51)	18 (46)	6 3/8 (16)
20 (51)	19 (48)	6 (15)
20 (51)	20 (51)	5 5/8 (14)
20 (51)	21 (53)	5 1/4 (13)
20 (51)	22 (56)	4 7/8 (12)
20 (51)	23 (58)	4 1/2 (11)
20 (51)	24 (61)	4 1/8 (10)
20 (51)	25 (64)	3 3/4 (9)
20 (51)	26 (66)	3 3/8 (8)
20 (51)	27 (69)	3 (7)
20 (51)	28 (71)	2 5/8 (6)
21 (53)	18 (46)	6 (15)
21 (53)	19 (48)	5 5/8 (14)
21 (53)	20 (51)	5 1/4 (13)
21 (53)	21 (53)	5 (12)
21 (53)	22 (56)	4 5/8 (11)
21 (53)	23 (58)	4 1/4 (10)
21 (53)	24 (61)	3 7/8 (10)
21 (53)	25 (64)	3 1/2 (9)
21 (53)	26 (66)	3 1/8 (8)
21 (53)	27 (69)	2 3/8 (7)
21 (53)	28 (71)	2 1/4 (6)
22 (56)	18 (46)	5 5/8 (14)
22 (56)	19 (48)	5 1/4 (13)
22 (56)	20 (51)	4 7/8 (12)
22 (56)	21 (53)	4 5/8 (11)
22 (56)	22 (56)	4 1/4 (10)
22 (56)	23 (58)	3 7/8 (10)
22 (56)	24 (61)	3 1/2 (9)
22 (56)	25 (64)	3 1/8 (8)
22 (56)	26 (66)	2 3/4 (7)
22 (56)	27 (69)	2 3/8 (6)
22 (56)	28 (71)	2 (5)
23 (58)	18 (46)	5 1/4 (13)
23 (58)	19 (48)	4 7/8 (12)
23 (58)	20 (51)	4 1/2 (11)
23 (58)	21 (53)	4 1/4 (10)
23 (58)	22 (56)	3 7/8 (10)
23 (58)	23 (58)	3 1/2 (9)
23 (58)	24 (61)	3 1/8 (8)
23 (58)	25 (64)	2 7/8 (7)
23 (58)	26 (66)	2 1/2 (6)
23 (58)	27 (69)	2 1/8 (5)
23 (58)	28 (71)	1 5/8 (4)

Range Length - L in. (cm)	Range Width - W in. (cm)	Radius - R in. (cm)
24 (61)	18 (46)	4 3/4 (12)
24 (61)	19 (48)	4 1/2 (11)
24 (61)	20 (51)	4 1/8 (10)
24 (61)	21 (53)	3 7/8 (10)
24 (61)	22 (56)	3 1/2 (9)
24 (61)	23 (58)	3 1/8 (8)
24 (61)	24 (61)	2 7/8 (7)
24 (61)	25 (64)	2 1/2 (6)
24 (61)	26 (66)	2 1/8 (5)
24 (61)	27 (69)	1 3/4 (4)
24 (61)	28 (71)	1 3/8 (3)
25 (64)	18 (46)	4 3/8 (11)
25 (64)	19 (48)	4 1/8 (10)
25 (64)	20 (51)	3 3/4 (10)
25 (64)	21 (53)	3 1/2 (9)
25 (64)	22 (56)	3 1/8 (8)
25 (64)	23 (58)	2 7/8 (7)
25 (64)	24 (61)	2 1/2 (6)
25 (64)	25 (64)	2 1/8 (5)
25 (64)	26 (66)	1 3/4 (4)
25 (64)	27 (69)	1 3/8 (3)
25 (64)	28 (71)	1 (2)
26 (66)	18 (46)	4 (10)
26 (66)	19 (48)	3 3/4 (10)
26 (66)	20 (51)	3 3/8 (9)
26 (66)	21 (53)	3 1/8 (8)
26 (66)	22 (56)	2 3/4 (7)
26 (66)	23 (58)	2 1/2 (6)
26 (66)	24 (61)	2 1/8 (5)
26 (66)	25 (64)	1 3/4 (4)
26 (66)	26 (66)	1 3/8 (3)
26 (66)	27 (69)	1 (2)
26 (66)	28 (71)	3/4 (2)
27 (69)	18 (46)	3 5/8 (9)
27 (69)	19 (48)	3 1/4 (8)
27 (69)	20 (51)	3 (8)
27 (69)	21 (53)	2 3/4 (7)
27 (69)	22 (56)	2 3/8 (6)
27 (69)	23 (58)	2 1/8 (5)
27 (69)	24 (61)	1 3/4 (4)
27 (69)	25 (64)	1 3/8 (3)
27 (69)	26 (66)	1 (2)
27 (69)	27 (69)	3/4 (2)
27 (69)	28 (71)	3/8 (1)
28 (71)	18 (46)	3 1/8 (8)
28 (71)	19 (48)	2 7/8 (7)
28 (71)	20 (51)	2 5/8 (7)
28 (71)	21 (53)	2 1/4 (6)
28 (71)	22 (56)	2 (5)
28 (71)	23 (58)	1 5/8 (4)
28 (71)	24 (61)	1 3/8 (3)
28 (71)	25 (64)	1 (2)
28 (71)	26 (66)	3/4 (2)
28 (71)	27 (69)	3/8 (1)
28 (71)	28 (71)	0 (0)

4. **Small Wok** (24 in. (61 cm) diameter x 6 in. (15 cm) depth maximum)

Two nozzles are available for small wok protection: High proximity and low proximity.

The 1H nozzle, Part No. 551029, is used for high proximity wok protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the appliance, 24 in. to 48 in. (61 to 122 cm) above the top edge of the wok and aimed at the center of the wok. See **Figure 3-6**.

The 1L nozzle, Part No. 551026, is used for low proximity wok protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the appliance, 13 in. to 24 in. (33 to 61 cm) above the top edge of the wok and aimed at the center of the wok. See **Figure 3-6**.

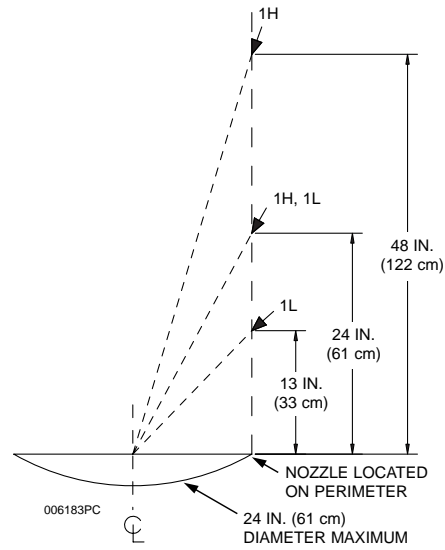


Figure 3-6

5. **Large Wok** (Greater than 24 in. to 30 in. (61 to 76 cm) diameter x 8 in. (20 cm) depth maximum)

Two nozzles are available for large wok protection: High proximity and low proximity.

The 2H nozzle, Part No. 551028, is used for high proximity wok protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the appliance, 24 in. to 48 in. (61 to 122 cm) above the top edge of the wok and aimed at the center of the wok. See **Figure 3-7**.

The 2L nozzle, Part No. 551027, is used for low proximity wok protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the appliance, 13 in. to 24 in. (33 to 61 cm) above the top edge of the wok and aimed at the center of the wok. See **Figure 3-7**.

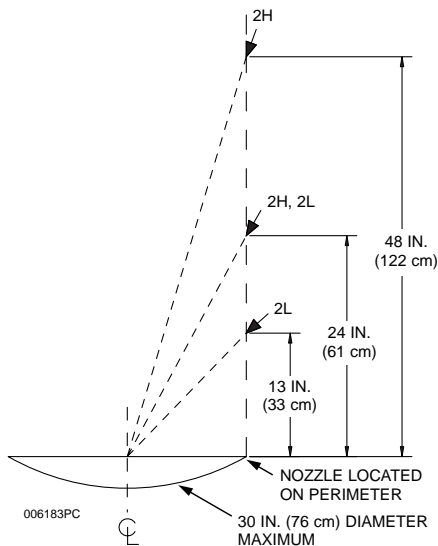


Figure 3-7

6. **Small Griddle** (1080 sq. in. (6968 sq. cm) x 36 in. (91 cm) longest side maximum)

Two nozzles are available for small griddle protection: High proximity and low proximity.

The 1H nozzle, Part No. 551029, is used for high proximity griddle protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **above any corner** of the hazard surface, 24 in. to 48 in. (61 to 122 cm) above the cooking surface of the appliance and aimed at a point 12 in. (31 cm) over and 12 in. (31 cm) in from the corner below the nozzle. See **Figure 3-8**.

The 1L nozzle, Part No. 551026, is used for low proximity griddle protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **above any corner** of the hazard surface, 10 in. to 24 in. (25 to 61 cm) above the cooking surface of the appliance and aimed at a point 12 in. (31 cm) over and 12 in. (31 cm) in from the corner below the nozzle. See **Figure 3-8**.

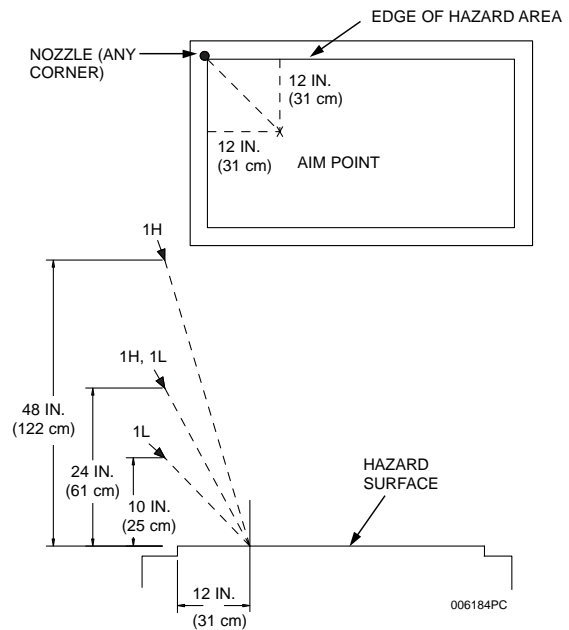


Figure 3-8

6a. **Small Griddle** (1080 sq. in. (6968 sq. cm) x 36 in. (91 cm) longest side maximum) **Alternate Protection**

Two nozzles are available for small griddle **alternate protection**: High proximity and low proximity.

The 2H nozzle, Part No. 551028, is used for high proximity griddle protection. This nozzle is a two (2) flow nozzle. The nozzle must be located 0 to 6 in. (0 to 15 cm) from short side of the hazard surface, 24 in. to 48 in. (61 to 122 cm) above the cooking surface of the appliance and aimed at the center of the hazard area. See **Figure 3-8a**.

The 2L nozzle, Part No. 551027, is used for low proximity griddle protection. This nozzle is a two (2) flow nozzle. The nozzle must be located 0 to 6 in. (0 to 15 cm) from the short side of the hazard surface, 13 in. to 24 in. (33 to 61 cm) above the cooking surface of the appliance and aimed at the center of the hazard area. See **Figure 3-8a**.

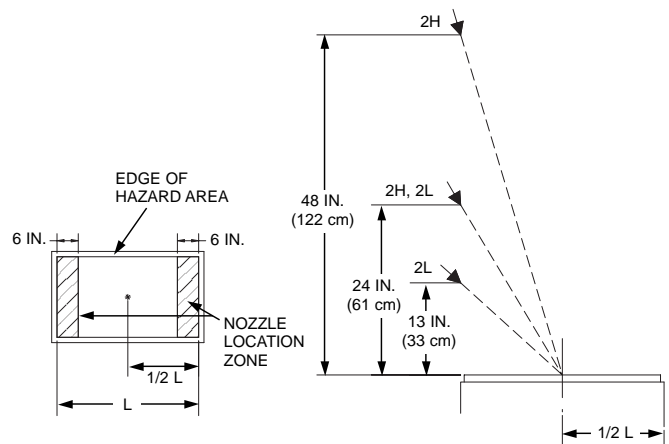


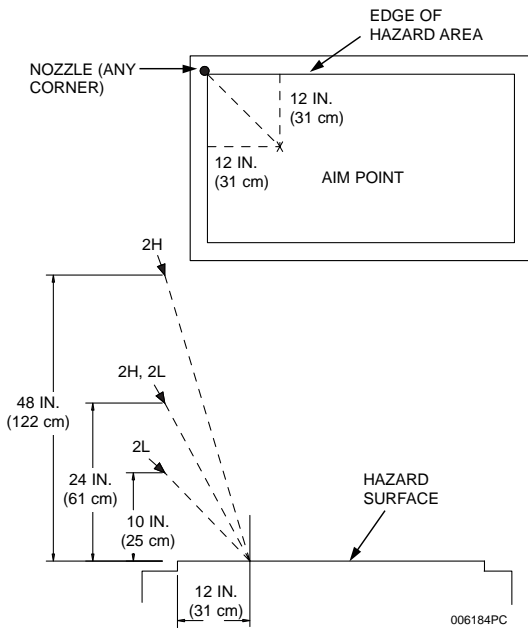
Figure 3-8a

**7. Large Griddle** (1440 sq. in. (9290 sq. cm) x 48 in. (122 cm) longest side maximum)

Two nozzles are available for large griddle protection: High proximity and low proximity.

The 2H nozzle, Part No. 551028, is used for high proximity griddle protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **above any corner** of the hazard surface, 24 in. to 48 in. (61 to 122 cm) above the cooking surface of the appliance and aimed at a point 12 in. (31 cm) over and 12 in. (31 cm) in from the corner below the nozzle. See **Figure 3-9**.

The 2L nozzle, Part No. 551027, is used for low proximity griddle protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **above any corner** of the hazard surface, 10 in. to 24 in. (25 cm to 61 cm) above the cooking surface of the appliance and aimed at a point 12 in. (31 cm) over and 12 in. (31 cm) in from the corner below the nozzle. See **Figure 3-9**.



**Figure 3-9**

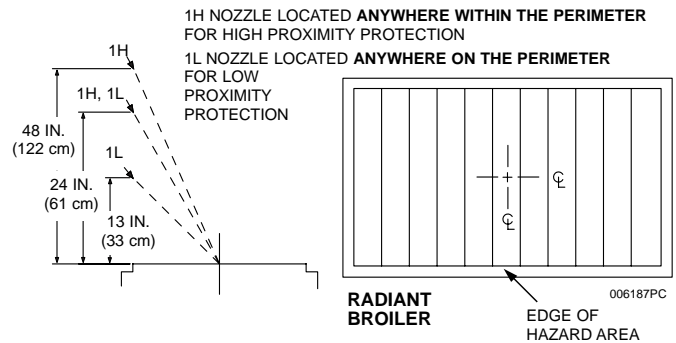
**8. Radiant Char-Broiler** (624 sq. in. (4026 sq. cm) x 26 in. (66 cm) longest side maximum)

**Note:** Radiant charbroilers are distinguished by the use of heated metal strips (radiants) that are used for cooking.

Two nozzles are available for radiant char-broiler protection. High proximity and low proximity.

The 1H nozzle, Part No. 551029, is used for high proximity radiant char-broiler protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **anywhere within the perimeter** of the hazard area, 24 in. to 48 in. (33 to 61 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-10**.

The 1L nozzle, Part No. 551026, is used for low proximity radiant char-broiler protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the hazard surface, 13 in. to 24 in. (33 to 61 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-10**.



**Figure 3-10**



9. **Radiant Char-Broiler** (864 sq. in. (2195 sq. cm) x 36 in. (91 cm) longest side maximum)

Two nozzles are available for radiant char-broiler protection: High proximity and low proximity.

The 2H nozzle, Part No. 551028, is used for high proximity radiant char-broiler protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **above any corner** of the hazard surface, 36 in. to 48 in. (91 to 122 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-11a**.

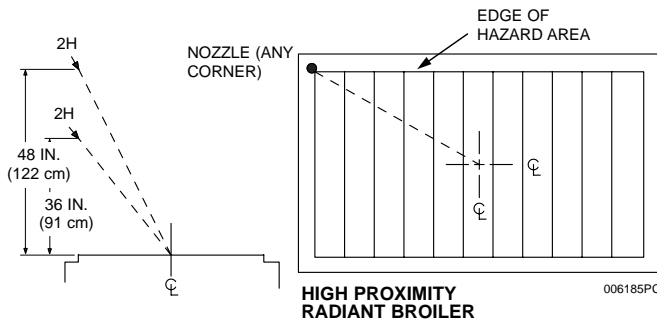


Figure 3-11a

The 2L nozzle, Part No. 551027, is used for low proximity radiant char-broiler protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the hazard surface, 13 in. to 36 in. (33 to 91 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-11b**.

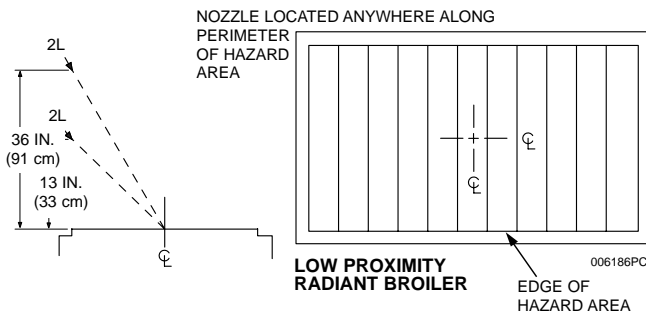


Figure 3-11b

10. **Lava Rock Char-Broiler** (624 sq. in. (4026 sq. cm) x 26 in. (66 cm) longest side maximum)

**Note:** Synthetic rock charbroilers are distinguished by the use of lava, pumice, or synthetic rocks that are used for cooking.

One nozzle is available for lava rock char-broiler protection. The 2L nozzle, Part No. 551027, is used for both high proximity and low proximity.

The 2L nozzle, Part No. 551027, is used for high proximity lava rock char-broiler protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere within the perimeter** of the hazard area, 24 in. to 35 in. (61 to 89 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-12**.

The 2L nozzle, Part No. 551027, is used for low proximity lava rock char-broiler protection. This nozzle is a two (2) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the hazard surface, 15 in. to 24 in. (38 to 61 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-12**.

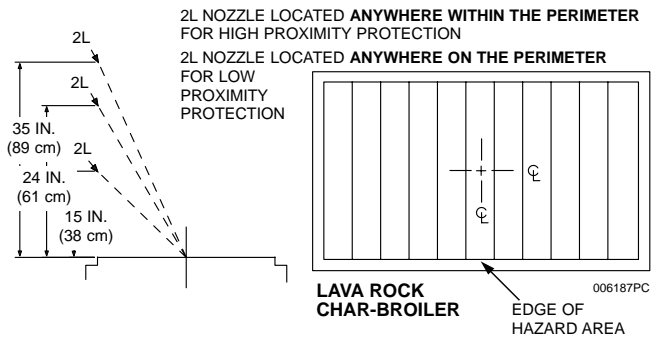


Figure 3-12

11. **Natural Class “A” Charcoal Char-Broiler** (480 sq. in. (3097 sq. cm) x 24 in. (61 cm) longest side maximum)

**Note:** Class “A” (natural) charbroilers are distinguished by the use of charcoal, mesquite chips, chunks, and/or logs that are used for cooking.

Two nozzles are available for natural charcoal char-broiler protection. High proximity and low proximity. The maximum depth of fuel (charcoal) must not exceed 6 in. (15 cm).

The 1H nozzle, Part No. 551029, is used for high proximity natural charcoal char-broiler protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **anywhere within the perimeter** of the hazard area, 24 in. to 35 in. (61 to 89 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-13**.

The 1L nozzle, Part No. 551026, is used for low proximity natural charcoal char-broiler protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the hazard surface, 15 in. to 24 in. (38 to 61 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-13**.

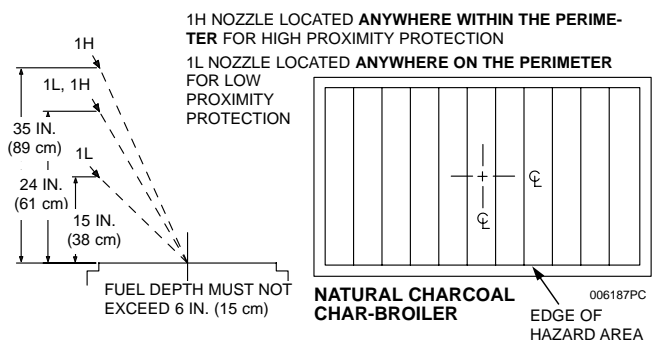


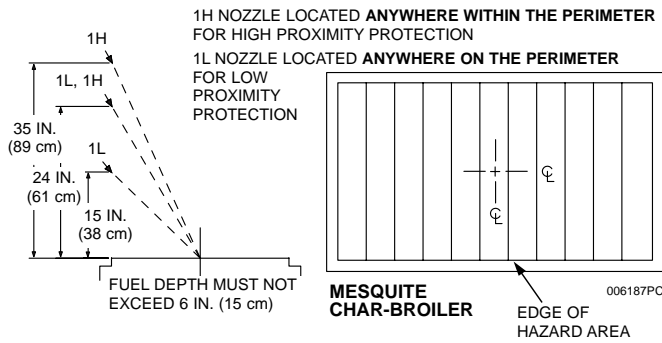
Figure 3-13

**12. Mesquite Char-Broiler** (480 sq. in. x (3097 sq. cm)  
 24 in. (61 cm) longest side maximum)

Two nozzles are available for mesquite char-broiler protection. High proximity and low proximity. The maximum depth of fuel (wood) must not exceed 6 in. (15 cm).

The 1H nozzle, Part No. 551029, is used for high proximity mesquite char-broiler protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **anywhere within the perimeter** of the hazard area, 24 in. to 35 in. (61 to 89 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-14**.

The 1L nozzle, Part No. 551026, is used for low proximity mesquite charcoal char-broiler protection. This nozzle is a one (1) flow nozzle. The nozzle must be located **anywhere on the perimeter** of the hazard surface, 15 in. to 24 in. (38 to 61 cm) above the cooking surface of the appliance and aimed at the center of the broiler surface. See **Figure 3-14**.

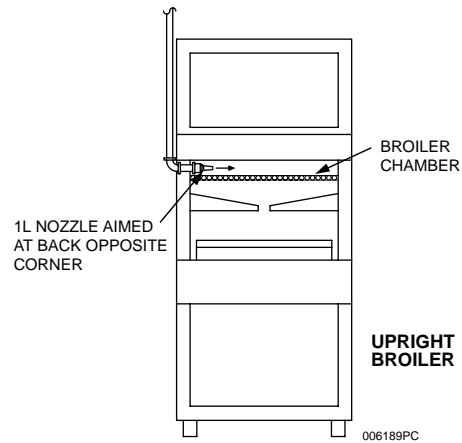
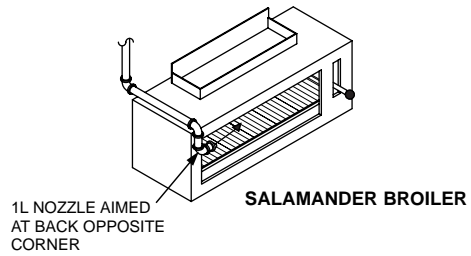


**Figure 3-14**

**13. Upright/Salamander Broiler** (internal chamber 1064 sq. in. x 36 in. (6865 sq. cm x 91 cm) longest side maximum)

One nozzle is available for upright/salamander broiler protection.

The 1L nozzle, Part No. 551026, is used for broiler protection. This nozzle is a one (1) flow nozzle. The nozzle must be located above the grate, at the front edge of the appliance, outside the broiling chamber, and pointed at the back opposite corner of the broiler chamber. The nozzle must be aimed parallel to the broiler grate surface. See **Figure 3-15**.

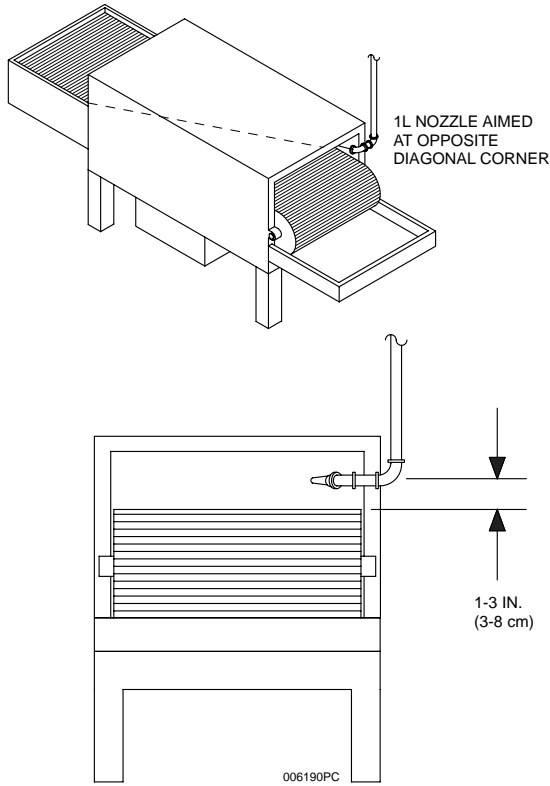


**Figure 3-15**

▶ **14. Chain Broiler** (internal chamber 1026 sq. in. (6619 sq. cm) x 38 in. (97 cm) longest side maximum)

One nozzle is available for chain broiler protection.

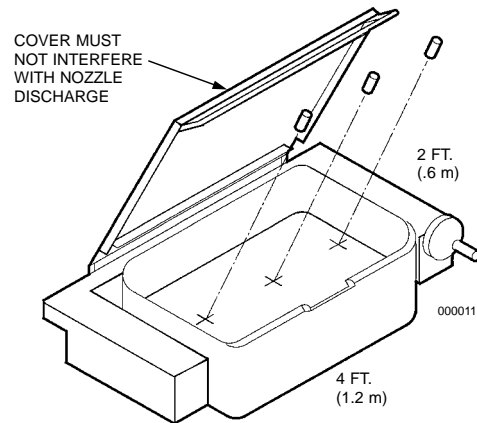
The 1L nozzle, Part No. 551026, is used for broiler protection. This nozzle is a one (1) flow nozzle. The nozzle must be located 1 to 3 in. (3 to 8 cm) above the surface of the chain, at the front edge of the appliance, and pointed at the opposite diagonal corner. The nozzle must be aimed parallel to the chain surface. See **Figure 3-16**.



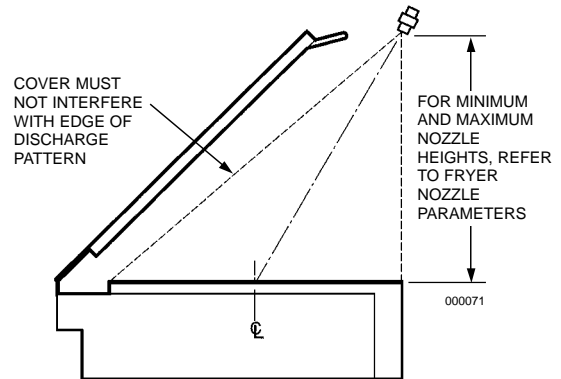
**Figure 3-16**

**15. Tilt Skillet/Braising Pan**

Protection for tilt skillet or braising pans is to be based upon the coverage limitations provided for deep fat fryer protection. Coverage limitations are based on fryer sizes including drip boards. Exception: Tilt skillets and braising pans may exceed the maximum of 6 sq. ft. (.6 sq. m) total when modularizing. Tilt skillets and braising pans generally utilize a hinged cover. Fryer protection nozzles are to be placed toward the front of the appliance to minimize the potential for the tilt skillet or braising pan cover to interfere with the nozzle discharge. See **Figure 3-17**.



THE NOZZLE IS TO BE PLACED TOWARD THE FRONT OF THE APPLIANCE TO MINIMIZE THE POTENTIAL FOR THE SKILLET OR BRAISING PAN COVER TO INTERFERE WITH THE NOZZLE DISCHARGE.



FRYER NOZZLE USED FOR TILT SKILLET OR BRAISING PAN PROTECTION MUST BE POSITIONED NEAR THE FRONT EDGE OF THE PAN AND AIMED AT THE FRONT TO BACK CENTERLINE OF THE PAN. THE DISCHARGE FROM THE NOZZLE(S) MUST COMPLETELY CLEAR THE PAN COVER WITH AN UNOBSTRUCTED VIEW TO THE BACK OF THE PAN.

**Figure 3-17**

## FRYER – MULTIPLE NOZZLE PROTECTION

Fryers exceeding the coverage of a single nozzle can be divided into modules. Each module must not exceed the maximum area allowed for a single nozzle. However, when utilizing multiple nozzle protection, the longest side allowed for a fryer with drip board can be used, regardless of whether the fryer has a drip board or not.

The maximum size fryer that can be modularized is 864 sq. in. (5574 sq. cm).

Design requirements for multiple nozzle fryers are broken down as follows:

1. If the fryer includes any dripboard areas, measure both the internal length (front to back) and width of the frypot portion. Then measure the internal length and width of the overall hazard area including any dripboard areas.

Determine the area of both the frypot and the area of the overall vat by multiplying corresponding length and width dimensions.

2. Divide the frypot or overall vat into modules, each of which can be protected by a single nozzle, based on the maximum dimension and area coverage of the nozzle as specified in "Design Chart."
  - If the module considered does not include any portion of the dripboard, use only the maximum frypot area and maximum dimension listed in the "Design Chart."
  - If the module considered includes any dripboard areas, use both the maximum frypot area and dimension listed in the "Design Chart", and the maximum overall area and dimension listed in the "Design Chart."
3. None of the maximum dimensions may be exceeded. If either the maximum frypot or the overall sizes are exceeded, the area divided into modules will need to be redefined with the possibility of an additional nozzle.

## PIPING LIMITATIONS

Once the nozzle placement and quantity of tanks has been determined, it is necessary to determine the piping configurations between the tank and the nozzles. This section contains the guidelines and limitations for designing the distribution piping so that the wet chemical agent will discharge from the nozzles at a proper flow rate. These limitations must also be referred to when selecting the mounting location for the tanks.

The maximum pipe lengths are based on internal pipe volume. Each size tank is allowed a minimum and maximum total volume of piping, calculated in milliliters.

There is no need to distinguish between what portion of the piping is supply line and what portion is branch line. Only the total volume of the complete piping network has to be considered.

### Volume Chart

1/4 in. pipe = 20.5 mls./ft.
3/8 in. pipe = 37.5 mls./ft.
1/2 in. pipe = 59.8 mls./ft.
3/4 in. pipe = 105.0 mls./ft.

### Tank Chart

Tank Size	Maximum Flow Numbers	Maximum Pipe Volume (milliliters)	Maximum Volume Allowed Between First Nozzle and Last Nozzle (milliliters)
3.0 Gallon PCL-300	10	1910	1125
4.6 Gallon PCL-460	14	3400	3000
4.6 Gallon PCI-460	15	2600	2000
6.0 Gallon PCL-600	19	4215	1688 per side
6.0 Gallon PCL-600	20	3465	1313 per side

## General Piping Requirements

1. Split piping and straight piping are both allowed on a PCL-300 and PCL-460 system.
2. PCL-600 systems must use split piping only, with no nozzle located before the split, and with a maximum of 14 flow points per side. 1/2 in. minimum piping must be used up to the first split.
3. Maximum volume for 1/4 in. pipe between a nozzle and the preceding tee is 410 mls.
4. Maximum flow numbers for 1/4 in. pipe is 6.
5. Maximum number of elbows between a nozzle and the preceding tee is 5.
6. Maximum of 25 elbows are allowed in the total piping system.
7. Maximum difference in elevation between the tank outlet and any nozzle, or the tank outlet and the highest or lowest horizontal pipe run, is 10 ft. (3.1 m).
8. No traps are allowed in the piping network.
9. Pipe lengths are measured from center to center of fittings.
10. The internal equivalent length volume of fittings does not have to be considered as part of the total pipe volume.
11. When utilizing different size pipe in the system, the largest size must start first and the additional pipe must decrease as it approaches the nozzle.
12. Elbow(s) or swivel adaptors located at the nozzles do not have to be counted in the 25 elbow maximum requirement.
13. Reducing bushings are allowed when reducing to a smaller pipe size.
14. Additional piping requirements when protecting a range, wok, or a fryer:
  - PCL-300 - Minimum of 300 ml and four (4) flow numbers required in total system. Of that minimum, 239 ml and two (2) flow numbers must be utilized at or before the range, wok, or fryer.
  - PCL-460 – Minimum of 660 ml and ten (10) flow numbers required in total system. Of that minimum, 180 ml and two (2) flow numbers must be utilized at or before the range, wok, or fryer.
  - PCL-600 – Minimum of 960 ml and fourteen (14) flow numbers required in total system. Of that minimum, 120 ml and 2 flow numbers must be utilized at or before the range, wok, or fryer.

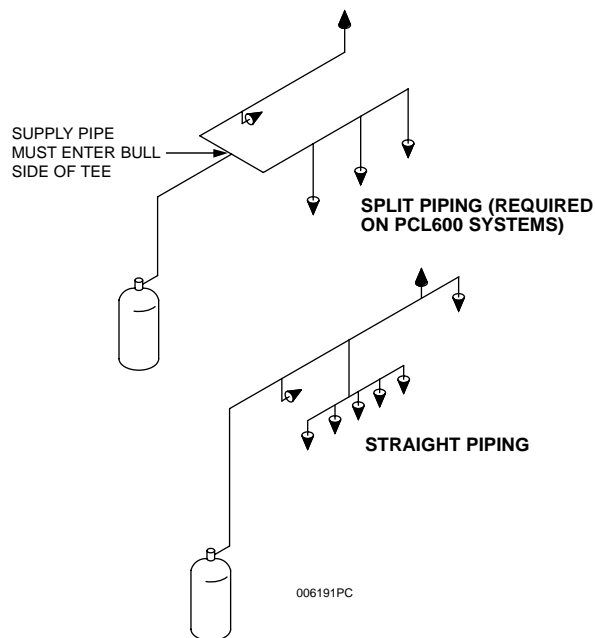


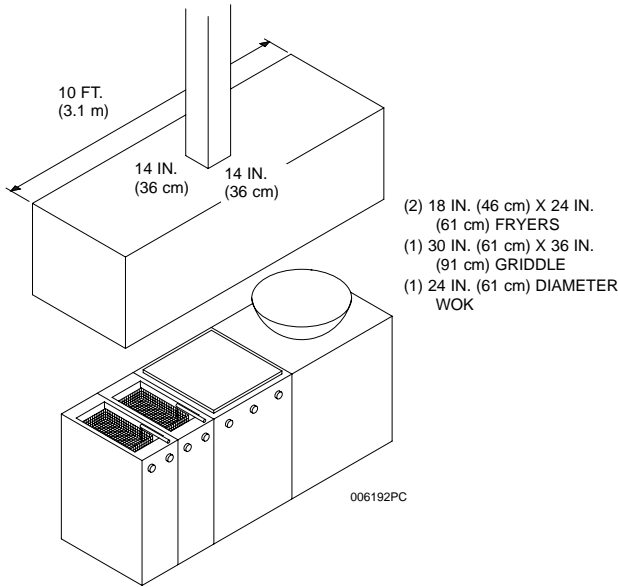
Figure 3-18

## Design Steps

- Step No. 1** Determine number of flow points required based on duct size, plenum size and type, and size of all appliances.
- Step No. 2** Determine size and quantity of tanks required. Refer to the chart in "General Piping Requirements" to determine the maximum amount of flow numbers allowed per each tank size.
- Step No. 3** Layout nozzles, piping diagram, and tank location. Determine pipe lengths as accurate as possible. Make certain maximum number of elbows is not exceeded. **Note: Tanks cannot be manifolded together. Each tank must have a separate piping network.**
- Step No. 4** Add all the lengths of each pipe run and multiply by the mls./ft. listed in the Volume Chart. If the sum falls within the acceptable range noted in general Piping Requirements, that pipe size is acceptable. If the calculated volume is too large, recalculate the volume using the ml per foot of a smaller pipe size. Pipe sizes can be mixed but Rule No. 11 of the General Piping Requirements must be followed.
- Step No. 5** Check to make certain minimum volumes, maximum volumes and maximum volume allowed between first nozzle and last nozzle is not exceeded (Tank Chart). Check each rule in "General Piping Requirement" to make certain none have been exceeded. If any requirement is exceeded, change to a different pipe size and recalculate.

**Example**

The cooking area that requires protection consists of a single 56 in. (142 cm) perimeter exhaust duct, a 10 ft. (3.1 m) long "V" bank plenum, (2) 18 in. (46 cm) wide x 24 in. (61 cm) fryers, a 30 in. (76 cm) x 36 in. (91 cm) wide griddle, and a 24 in. (61 cm) diameter wok. See **Figure 3-19**.



**Figure 3-19**

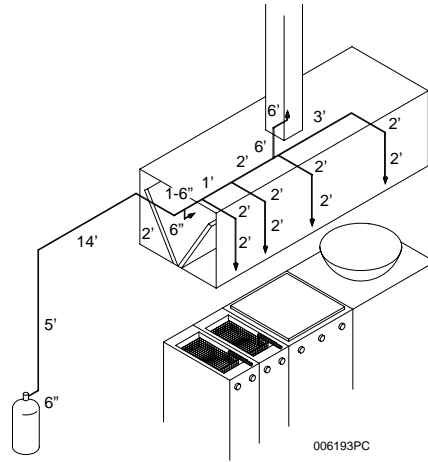
**Step No. 1** Determine number of flow points required.

- 56 in. (142 cm) perimeter duct requires one, **two flow** nozzle
- 10 ft. (3.1 m) "V" bank hood requires one, **one flow** nozzle
- 18 in. x 24 in. (46 x 61 cm) fryer requires one, **two flow** nozzle
- 18 in. x 24 in. (46 x 61 cm) fryer requires one, **two flow** nozzle
- 30 in. x 36 in. (76 x 91 cm) griddle requires one, **one flow** nozzle
- 24 in. (61 cm) diameter wok requires one, **one flow** nozzle

**TOTAL FLOW NUMBERS – 9**

**Step No. 2** Determine size and quantity of tanks required. Referring to the chart in "General Piping Requirements", a PCL-300 and a PCL-460 can supply 10 flows, therefore, a PCL-300 can be utilized.

**Step No. 3** Make an accurate sketch of the cooking lineup and the hood. Sketch in the tank location and all the piping required for the total system. Make certain all pipe lengths and number of elbows are as accurate as possible. Check the "General Piping Requirements" to determine that the minimum and maximum requirements are met. See **Figure 3-20**.



**Figure 3-20**

**Step No. 4** Total all pipe lengths. Refer to the Volume Chart. Chose a given pipe size and multiply the ml per foot by the total length of all the pipe. If the sum falls within the acceptable range noted in Tank Chart, that pipe size is acceptable. If the calculated volume is too large, recalculate the volume using the ml per foot of a smaller pipe size. See **Figure 3-21**.

Add section A-B = 0'-6" + 5' + 14' + 2' + 0'-6" = **22'**  
 (.2 + 1.5 + 4.3 + .6 + .2 = **6.8 m**)

Add section B-C = **1'-6" (.5 m)**

Add section C-D = **1' (.3 m)**

Add section D-E = **2' (.6 m)**

Add section E-F = **0'-6" (.2 m)**

Add section F-L = 3' + 2' + 2' = **7' (2.1 m)**

Add section B-G = **0'-6" (.2 m)**

Add section C-H = 2' + 2' = **4' (.6 + .6 = 1.2 m)**

Add section D-I = 2' + 2' = **4' (.6 + .6 = 1.2 m)**

Add section E-J = 0'-6" + 0'-6" = **1' (.3 m)**

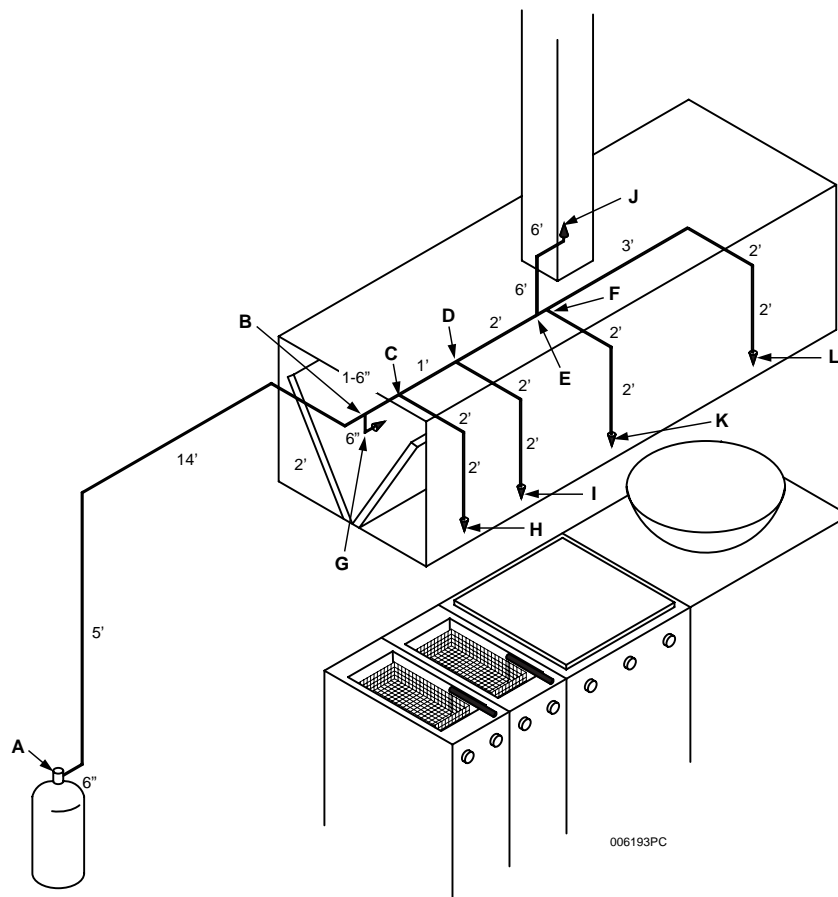
Add section F-K = 2' + 2' = **4' (.6 + .6 = 1.2 m)**

**Total length of all pipe = 47'-6" (14.5 m)**

Refer to Volume Chart. The pipe size chosen is 3/8 inch. The volume per foot of 3/8 in. pipe is 37.5 ml. Multiply 37.5 by the total pipe length of 47.5 ft.

37.5 ml x 47.5 ft. = 1781 ml total volume

The maximum volume allowed for a PCL-300 is 1910 ml, therefore, 3/8 in. pipe is acceptable for this system.



**Figure 3-21**

**Step No. 5** Check to make certain minimum volumes and maximum volume allowed between first nozzle and last nozzle are not exceeded (Tank Chart). Check each rule in "General Piping Requirements" to make certain none have been exceeded. If any requirement is exceeded, change to a different pipe size and recalculate. See **Figure 3-22**.

**Refer to Tank Chart**

**Minimum Pipe Volume for PCL-300 is 300 milliliters protecting a fryer, wok, or range** (Example system pipe volume is 1781 milliliters, therefore OK)

**Maximum Pipe Volume for PCL-300 is 1910 milliliters** (Example system pipe volume is 1781 milliliters, therefore OK)

**Maximum Volume Allowed Between First Nozzle and Last Nozzle for PCL-300 is 1125 milliliters** (Example system, the amount of 3/8 in. piping between G and L, is 25.5 feet.  $25.5 \text{ feet} \times 37.5 \text{ mls./ft.} = 956.3 \text{ ml}$ , therefore, OK)

**Refer to General Piping Requirements**

1. **Split piping and straight piping are both allowed on PCL-300 and PCL-460 systems.** (Example system OK)
2. **PCL-600 systems must use split piping only, with no nozzle located before the split, and with a maximum of 14 flow points per side. 1/2 in. minimum piping must be used up to the first split.** (Example system N/A)
3. **Maximum volume for 1/4 in. pipe between a nozzle and the preceding tee is 410 mls.** (Example system N/A)
4. **Maximum flow numbers for 1/4 in. pipe is 6.** (Example system N/A)
5. **Maximum number of elbows between a nozzle and the preceding tee is 5.** (Example system has a maximum number of 2, therefore, OK)
6. **Maximum of 25 elbows are allowed in the total piping system.** (Example system has 11 elbows, therefore, OK)
7. **Maximum difference in elevation between the tank outlet and any nozzle, or the tank outlet and the highest or lowest horizontal pipe run, is 10 ft. (3.1 m)** (Example system has 5'-6" (1.7 m), therefore, OK)
8. **No traps are allowed in the piping network.** (Example system has no traps, therefore, OK)
9. **Pipe lengths are measured from center to center of fittings.** (Example system pipe lengths were measured from center to center of fittings, therefore, OK)

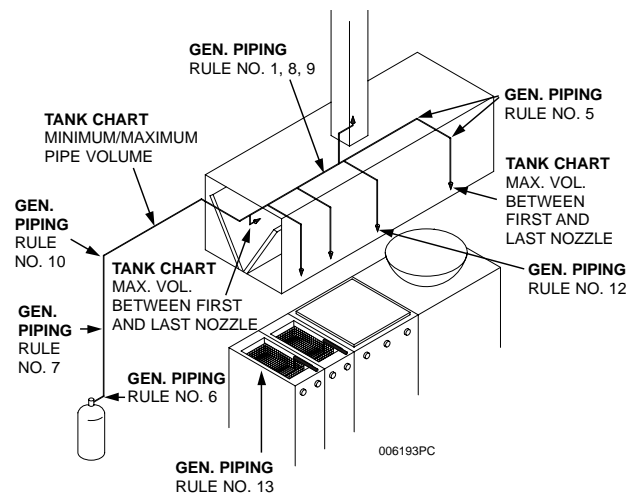
**10. The internal equivalent length volume of fittings does not have to be considered as part of the total pipe volume.** (Example system OK)

**11. When utilizing different size pipe in the total system, the largest size must start first and the additional pipe must decrease as it approaches the nozzle.** (Example system N/A)

**12. Elbow(s) or swivel adaptors located at the nozzles do not have to be counted in the 25 elbow maximum requirement.** (Example system OK)

**13. Additional piping requirements when protecting a range, wok, or a fryer:**

- **PCL-300 - Minimum of 300 ml and four (4) flow numbers required in total system. Of that minimum, 239 ml and two (2) flow numbers must be utilized at or before the range, wok, or fryer.** (Example system has 1781 ml and 10 flow numbers, therefore, OK. The example system has 1050 ml and 3 flows including the fryer, therefore, OK)
- **PCL-460 – Minimum of 660 ml and ten (10) flow numbers required in total system. Of that minimum, 180 ml and two (2) flow numbers must be utilized at or before the range, wok, or fryer.**
- **PCL-600 – Minimum of 960 ml and fourteen (14) flow numbers required in total system. Of that minimum, 120 ml and 2 flow numbers must be utilized at or before the range, wok, or fryer.**



**Figure 3-22**



## DETECTOR PLACEMENT

Detectors are required over cooking appliances and in the duct(s) of protected ventilation hoods. Detectors shall be located in the plenum area of the ventilation hood.

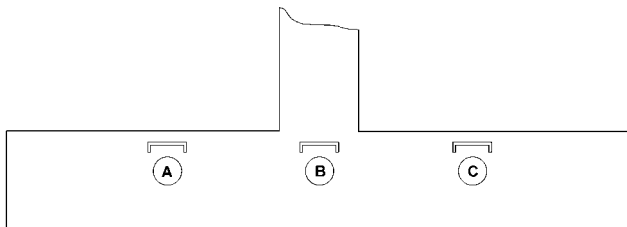
### 1. Exhaust Duct(s).

Each exhaust duct must have at least one (1) detector installed in the duct entrance, located in the air stream of the cooking vapors at a maximum of 12 feet (3.7 m) into the duct, centered. See **Figure 3-25**.

### 2. Cooking Appliance(s).

Each cooking appliance with a continuous cooking surface not exceeding 48 in. x 48 in. (122 x 122 cm) shall be protected by one (1) detector. Cooking appliances with a continuous cooking surface exceeding 48 in. x 48 in. (122 x 122 cm) shall be protected by one (1) detector per 48 in. x 48 in. (122 x 122 cm) cooking area. Detectors used for cooking appliances must be located within the perimeter of the protected appliance toward the exhaust duct side of the appliance. The detector should be located in the air stream of the appliance to enhance system response time.

If a cooking appliance is located under a duct opening where a detector has been mounted, it is not necessary to utilize an additional detector provided the duct detector is not more than 12 in. (31 cm) into the duct opening. If two (2) appliances are located under a duct opening where a detector has been mounted, it is not necessary to utilize an additional detector provided the duct detector is not more than 12 in. (31 cm) into the duct opening. See **Figure 3-23**.



APPLIANCE COVERED BY DETECTOR A	APPLIANCE COVERED BY DETECTOR B	APPLIANCE COVERED BY DETECTOR B	APPLIANCE COVERED BY DETECTOR C
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**Figure 3-23. Proper Detector Placement.**

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