Signature Series

Intelligent Smoke and Heat Detectors
Applications Bulletin

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CREDITS	This manual was designed and written by the EST Technical Services - Documentation Department, Sarasota.

DOCUMENT HISTORY

Date	Revision	Reason for change
August 1994	0.0	Initial Release for U.L.
December 1994	1.0	Minor corrections. Release to field personnel.
July 1999	2.0	Major layout change and minor corrections and changes.
March 2000	3.0	Updated Smoke Detector Application table for SIGA-PS. For open wood fires listed as optimal, changed to unsuitable.

Content

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Related Documentation

	National Fire Protection Association (NFPA) 1 Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101
NFPA 70	National Electric Code
NFPA 72	National Fire Alarm Code
	Underwriters Laboratories, Inc. (ULI) 333 Pfingsten Road Northbrook, IL 60062-2096
UL 38	Manually Actuated Signaling Boxes
UL217	Smoke Detectors, Single & Multiple Station
UL 228	Door Closers/Holders for Fire Protective Signaling Systems
UL 268	Smoke Detectors for Fire Protective Signaling Systems
UL 268A	Smoke Detectors for Duct Applications
UL 346	Waterflow Indicators for Fire Protective Signaling Systems
UL 464	Audible Signaling Appliances
UL 521	Heat Detectors for Fire Protective Signaling Systems
UL 864	Standard for Control Units for Fire Protective Signaling Systems
UL 1481	Power Supplies for Fire Protective Signaling Systems
UL 1638	Visual Signaling Appliances
UL 1971	Visual Signaling Appliances
	Underwriters Laboratories of Canada (ULC) 7 Crouse Road Scarborough, Ontario M1R 3A9
ULC S527	Standard for Control Units for Fire Alarm Systems
ULC S524	Standard for the Installation of Fire Alarm Systems
ULC S536	Standard for the Inspection and Testing of Fire Alarm Systems
ULC S537	Standard for the Verification of Fire Alarm Systems
PLUS...	Requirements of state and local building codes. Requirements of the Authority Having Jurisdiction.

Overview of Signature Series Smoke and Heat Detectors

The Signature Series family of detectors is comprised of a variety of detection technologies available in various combinations to meet the needs of the fire protection community. The detectors are constructed of a white, high-impact polymer. All detectors plug into one of a variety of mounting bases or duct housings and feature base locking tabs. The table below lists the available detector models.

Signature Series Smoke and Heat Detectors

Model	Description
SIGA-IS	Ionization Smoke Detector
SIGA-PS	Photoelectric Smoke Detector
SIGA-PHS	Combination Photoelectric Smoke and 135° F (57° C) Fixed-Temperature Heat Detector
SIGA-IPHS	Combination Ionization, Photoelectric, and Thermal Boost Type Smoke Detector. An (Δ65° F (Δ57° C) above ambient temperature change in a 1 hour period will produce an alarm.
SIGA-HFS	135° F (57° C) Fixed-Temperature Heat Detector
SIGA-HRS	Combination 15° F per minute Rate-of-Rise, and 135° F (57° C) Fixed-Temperature Heat Detector

Signature Series smoke and heat detectors are intelligent analog addressable devices that contain their own microprocessors which allow them to make alarm decisions based on the information collected by their sensors. Depending on the detector, decisions may be based on the information gathered by up to three independent sensing elements.

All Signature Series detectors feature electronic addressing. The address of each detector is assigned electronically via the Signature Series Data Entry Program and stored in the detector's on-board memory. No addressing switches are used.

Signature Series detectors provide two LEDs which indicate the detector's condition. In normal condition, the network control panel performs background supervision indicated by the flashing green LED. An alarm condition is indicated by the flashing red LED. In the event of a loss of communication in some systems, the detector operates in standalone mode as indicated by the steady operation of both LEDs during an alarm condition, as long as it maintains circuit continuity to the control panel.

Signature Series detectors are capable of performing and storing a comprehensive range of self-diagnostic measurements. Information regarding a detector's hours of operation, last maintenance date, sensitivity values, and number of recorded alarms and troubles may be stored in EEPROM of the detector.

Multiple sensing technologies are incorporated into SIGA-PHS, SIGA-IPHS, and SIGA-HRS detectors, which makes them suitable for a wide range of applications. The tables in the Heat Detector Applications section of this document list the applications suitable for the SIGA-HFS and SIGA-HRS. Tables in the Smoke Detector Applications section list the applications suitable for the SIGA-IS, SIGA-PS, SIGA-PHS, and SIGA-IPHS.

SIGA-IS, SIGA-PS, SIGA-PHS, and SIGA-IPHS detectors offer a variety of sensitivity settings. The alarm sensitivity is the minimum obscuration level at which the detector will initiate an alarm condition. The alarm sensitivity level may be changed to any of five sensitivity settings using the Signature Series Data Entry Program.

All Signature Series smoke detectors offer alarm verification, which is used to validate an alarm condition before it is processed by the control panel. When enabled, the alarm verification tries to reset a detector that has initiated an alarm condition. If the detector cannot be reset or if it returns to its alarm condition within the required time window, the alarm is considered valid and is processed by the control panel.

Heat Detector Applications

Heat detectors sense change in air temperature and initiate alarm conditions based on a fixed-temperature point, rate of temperature rise, or amount of temperature rise above ambient condition. Spot type heat detectors should be selected so that the rating is at least 20° F (11° C) above maximum expected ceiling temperature. Ceiling height, construction, and ventilation play significant roles in detector performance and must be considered when determining detector placement.

Intelligent Fixed-Temperature Heat Detector (SIGA-HFS)

The table below lists six standard types of fire and the suitability of the SIGA-HFS for each. The SIGA-HFS contains a 135° F (57° C) fixed-temperature heat sensor which is best suitable for detecting fast, flaming fires such as open wood and liquid fires without smoke.

SIGA-HFS Applications

Type of Fire	Suitability of SIGA-HFS
Open Wood	Optimal
Wood Pyrolysis	Unsuitable
Smoldering Cotton	Unsuitable
PU Foam	Suitable
n-Heptane	Very Suitable
Liquid Fire without Smoke	Optimal

Intelligent Rate-of Rise/Fixed Temperature Heat Detector (SIGA-HRS)

The table below lists six standard types of fire and the suitability of the SIGA-PHS for each. The SIGA-HRS contains a 15° F per minute rate-of-rise heat sensor and a 135° F (57° C) fixed-temperature heat sensor which are best suitable for detecting fast, flaming fires such as open wood and liquid fires without smoke.

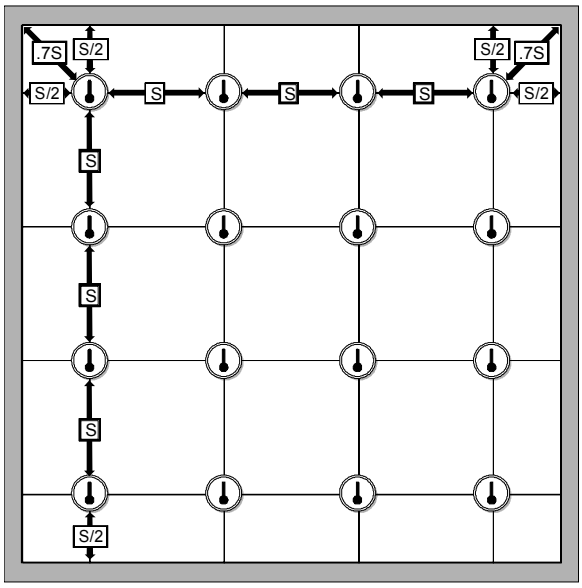
SIGA-HRS Applications

Type of Fire	Suitability of SIGA-HRS
Open Wood	Optimal
Wood Pyrolysis	Unsuitable
Smoldering Cotton	Unsuitable
PU Foam	Suitable

n-Heptane	Very Suitable
Liquid Fire without Smoke	Optimal

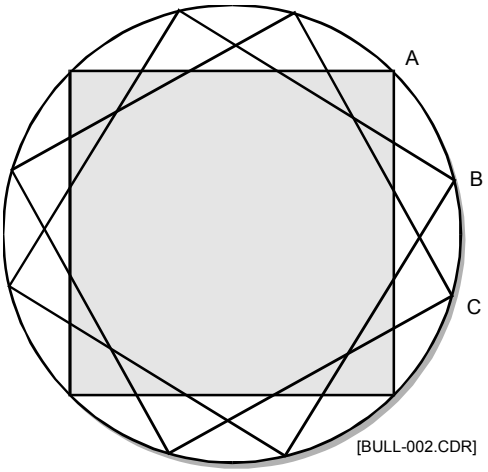
Spacing of Heat Detectors

Spot type heat detector spacing ratings are based on detector installation on a flat smooth ceiling that is 10 feet (3m) high. The listed spacing equates detector operation with the opening of a standard sprinkler head within 2 minutes (+/- 10 seconds) located 10 feet (3m) from the same fire. Spot type detector spacing is shown in the figure below. Detector coverage is typically represented as a square because most structures have flat sidewalls. Actual detector coverage covers a circle whose radius is 0.7 times the listed spacing. Since all of the area within the detector's circle of coverage is suitable for detecting a fire, the shape and dimensions of the detector coverage "square" in the figure below may be modified. Note that, although the coverage "square" is now a "rectangle," the coverage area remains within the overall detector circle of coverage.

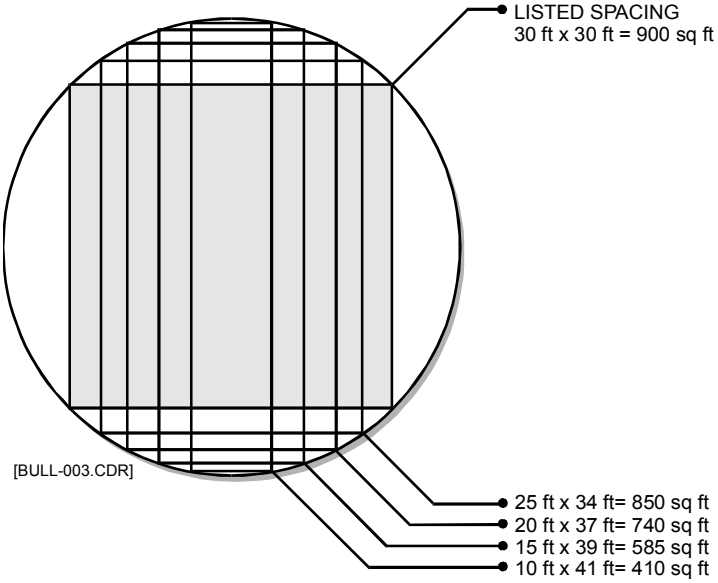


Listed Heat Detector Spacing

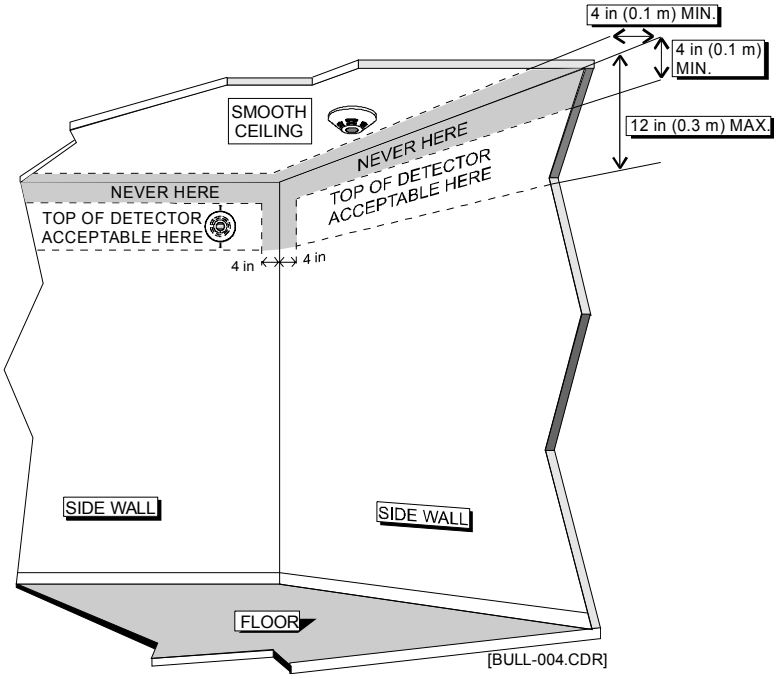
Note: A spot type heat detector will cover all points located within 0.7 time the listed spacing. The listed spacing for Signature Series heat detectors is S = 70 ft (21.3 m).



Detector's Circle of Coverage



Alternate Heat Detector Coverage Configurations



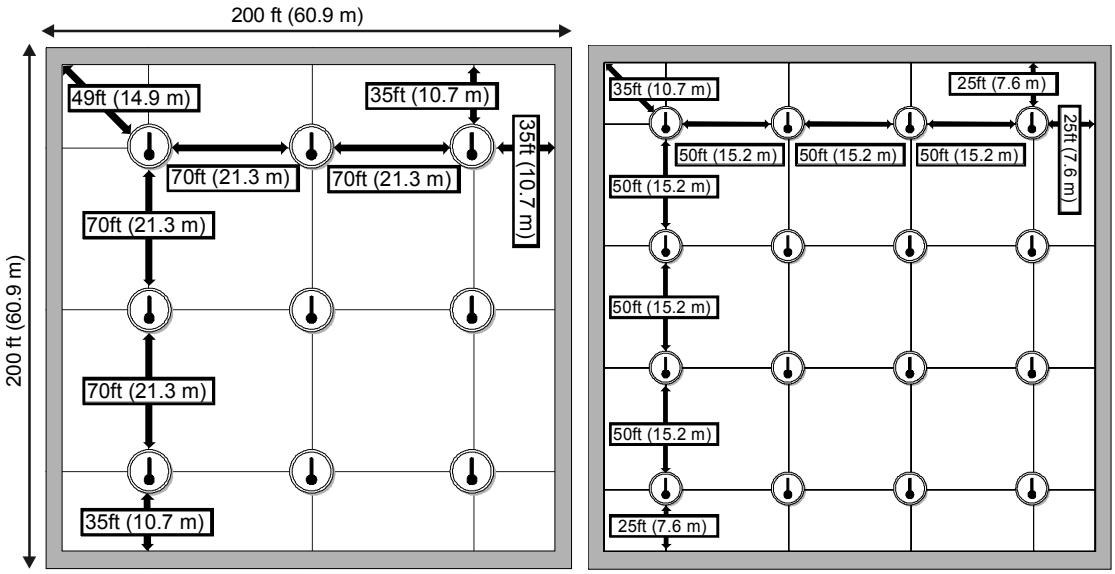
Detector Placement Near Ceiling/Wall Joints

When installed on the ceiling, spot type heat detectors must be located a minimum of 4 in (10 cm) from side walls. When installed on side walls, the detector must be between 4 in (10 cm) and 12 in (30 cm) from the ceiling, as shown above.

Spacing Signature Series Heat Detectors

The figure below shows the required heat detector spacing for a 200 ft (60.9m) by 200 ft (60.9m) room with a 10 ft (3m) ceiling. The right half of the figure shows 16 heat detectors with a required listed spacing of S = 50 ft (15.2m). The left half of the figure shows only 9 heat detectors with a required listed spacing of S = 70 ft (21.3m).

Note: Signature Series heat detectors provide 96% greater coverage than a typical heat detector with a linear spacing rating of S = 50 ft (15.2m).



Heat Detector Spacing

Ceiling Height and Construction

When heat detectors are installed on other than flat smooth ceilings or at ceiling heights greater than 10 ft (3m), spacing adjustments must be made. The table below lists the reduction in listed spacing that must be applied when detectors are mounted on ceilings higher than 10 ft (3m). This reduced spacing yields the equivalent response of detectors located on a 10 ft (3m) ceiling.

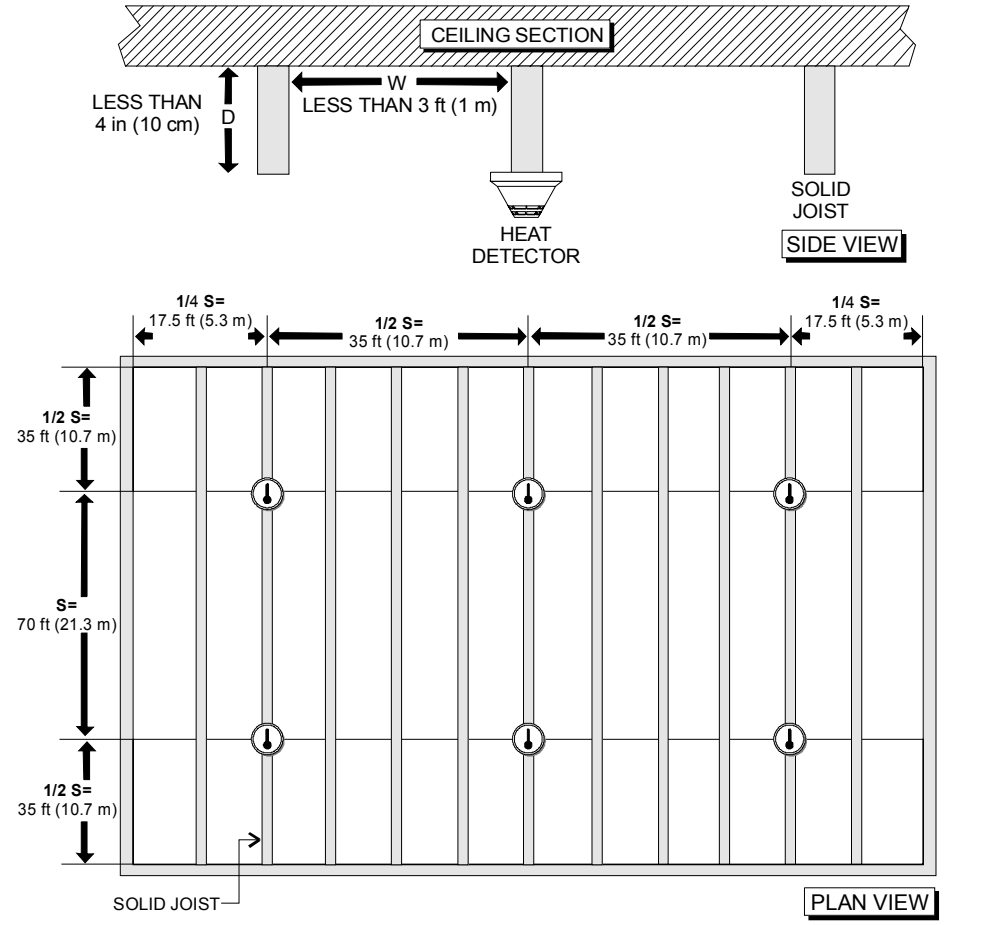
Spot Type Detector Ceiling Height Reduction Percentages

Ceiling Height	Percent of Listed Spacing	SIGA-HFS and SIGA-HRS Listed Spacing
0 to 10 ft (0 to 3 m)	100	70 ft (21.3 m)
10 to 12 ft (3 to 3.7 m)	91	63 ft (19.2 m)
12 to 14 ft (3.7 to 4.3 m)	84	58 ft (17.7 m)
14 to 16 ft (4.3 to 4.9 m)	77	53 ft (16.2 m)
16 to 18 ft (4.9 to 5.5 m)	71	49 ft (14.9 m)
18 to 20 ft (5.5 to 6.0 m)	64	44 ft (13.4 m)
20 to 22 ft (6.0 to 6.7 m)	58	40 ft (12.2 m)
22 to 24 ft (6.7 to 7.3 m)	52	36 ft (11.0 m)

24 to 26 ft (7.3 to 7.9 m)	46	32 ft (9.8 m)
26 to 28 ft (7.9 to 8.5 m)	40	28 ft (8.5 m)
28 to 30 ft (8.5 to 9.1 m)	34	23 ft (7.0 m)

Exposed Solid Joists

Exposed solid ceiling joists may impede the flow of heat detectors. When spacing spot type heat detectors, a joist is defined as any solid member extending 4 in (10 cm) or more down from the ceiling and spaced less than 3 ft (1m) apart. The spacing of heat detectors shall be reduced by 50% in the direction perpendicular to the joist. The detectors must be mounted on the bottom of the joists.



KEY

=HEAT DETECTOR

D =DEPTH OF JOIST

W=JOIST SPACING

NOTES

1. JOISTS LESS THAN 4 in (10 cm) DEEP ARE CONSIDERED FLAT CEILINGS. HEAT DETECTORS MUST BE MOUNTED ON BOTTOM OF JOISTS.
2. SPACING PERPENDICULAR TO JOISTS DEEPER THAN 4 in (10 cm) MUST BE REDUCED BY 50% OF LISTED SPACING.

[BULL-006.CDR]

Heat Detector Spacing - Solid Joist Construction

Exposed Beams

Exposed beams may impede the flow of heat detectors. Beams are defined as members extending 4 in (10cm) or more down from the ceiling and spaced more than 3 ft (1m) apart. The spacing of heat detectors shall be reduced by 33% in the direction perpendicular to the beam. Detectors may be mounted on the bottom of the beams which are less than 12 in (30.4 cm) in depth and less than 8 ft (2.4m) on center, then each bay created by the beams must have at least one detector mounted on the ceiling.

Heat detectors should be mounted on the ceiling in each bay if the ratio of beam depth (D) to ceiling height (H), D/H, is greater than 0.1 and the ratio of beam spacing (W) to ceiling height (H), W/H, is greater than 0.4.

Heat detectors should be mounted on the bottom of each if either the ratio of beam depth (D) to ceiling height (H), D/H, is less than 0.1 or the ratio of beam spacing (W) to ceiling height (H), W/H, is less than 0.4.

Calculation

$\frac{D}{H} > 0.1$ AND $\frac{W}{H} > 0.4$, then mount the detector on the ceiling.

$\frac{D}{H} < 0.1$ OR $\frac{W}{H} < 0.4$, then mount the detector on the bottom of the joist.

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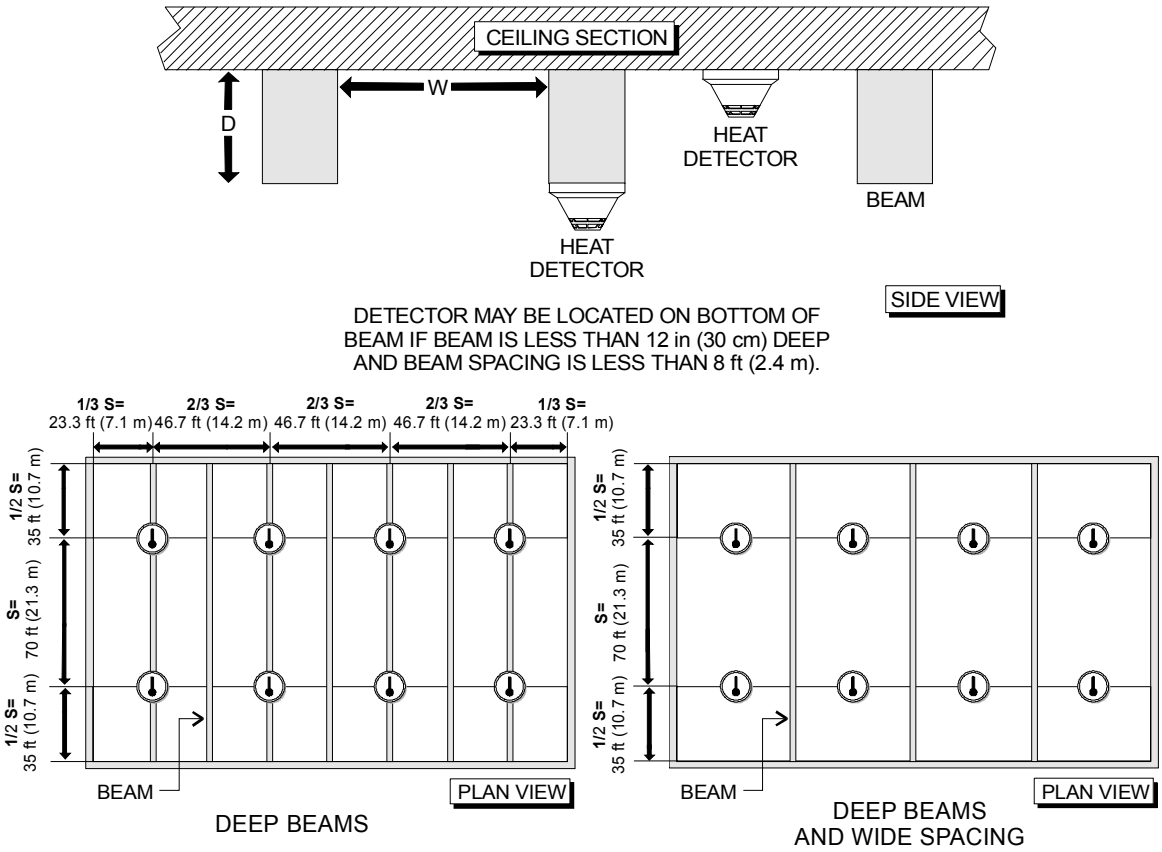


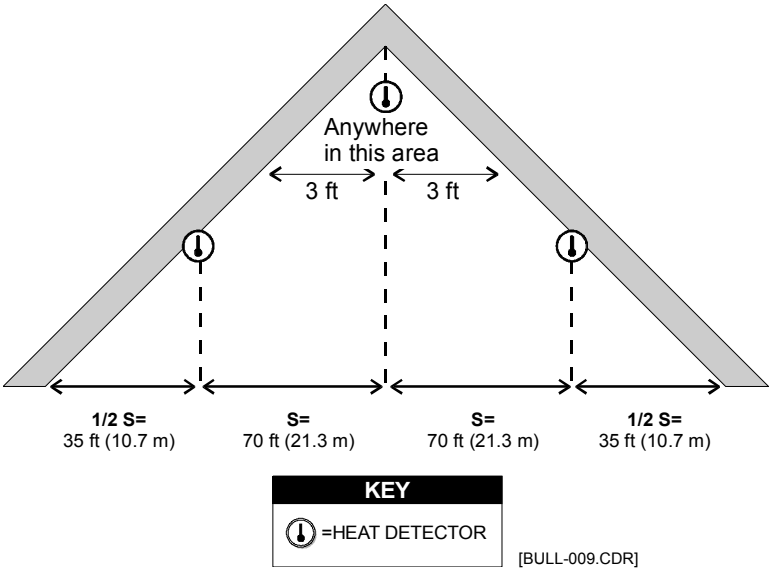
Heat Detector Spacing - Beam Construction

Sloped Ceilings

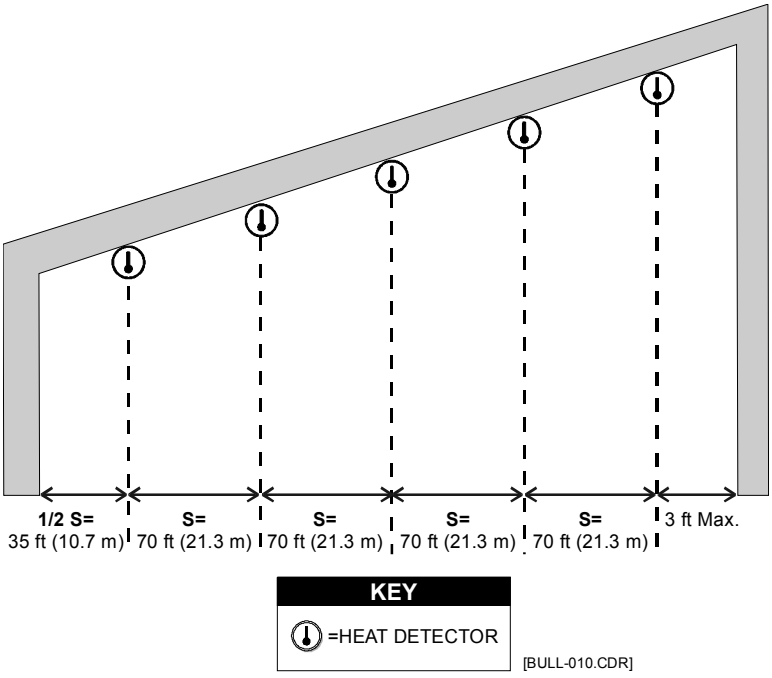
Rooms with peaked ceilings shall have the first row of detectors placed within 3 ft (1m) (measured horizontally) of the ceiling peak. Additional detectors, if required, shall be spaced based upon the horizontal projection of the ceiling and ceiling construction.

Rooms with shed ceilings having a slope greater than 1 ft in 8 ft (or, 1m in 8m) shall have the first row of detectors within 3-ft (1m) of the high end of the ceiling and ceiling construction. For roofs having a slope less

than 30°, horizontal spacing shall be adjusted according to the height and peak. For roofs having a slope greater than 30°, horizontal spacing shall be adjusted according to the average sloped ceiling height.



Heat Detector Spacing - Peaked Ceiling



Heat Detector Spacing - Sloped Ceiling

Smoke Detector Applications

Regardless of the principle of operation (e.g., ionization, photoelectric), smoke detectors sense the presence of smoke particles. In order for a smoke detector to sense these particles, smoke must travel from the point of origin to the detector. When evaluating a particular building or location for detector layout, likely fire locations should first be determined, and paths of smoke travel from each of these fire locations should be determined. Wherever practical, actual field tests should be conducted. The most desired location for smoke detectors would be the common points of intersection of smoke travel from fire locations throughout the building. Ceiling height, construction, and ventilation play significant roles in smoke detector performance.

Intelligent Ionization Smoke Detector (SIGA-IS)

The table below lists six standard types of fire and the suitability of the SIGA-IS for each. Ionization smoke detectors have a wide range of fire sensing capabilities and are best suited for detecting fast, flaming fires such as open wood and n-Heptane fires.

SIGA-IS Applications

Type of Fire	Suitability of SIGA-IS
Open Wood	Optimal
Wood Pyrolysis	Suitable
Smoldering Cotton	Very Suitable
PU Foam	Very Suitable
n-Heptane	Optimal
Liquid Fire without Smoke	Unsuitable

Intelligent Photoelectric Smoke Detector (SIGA-PS)

The table below lists six standard types of fire and the suitability of the SIGA-PS for each. Photoelectric smoke detectors have a wide range of fire sensing capabilities and are best suited for detecting slow, smoldering fires such as wood pyrolysis and smoldering cotton.

SIGA-PS Applications

Type of Fire	Suitability of SIGA-PS
Open Wood	Unsuitable
Wood Pyrolysis	Optimal

Smoldering Cotton	Optimal
PU Foam	Very Suitable
n-Heptane	Very Suitable
Liquid Fire without Smoke	Unsuitable

Intelligent 3D Multisensor Smoke Detector (SIGA-PHS)

The table below lists six standard types of fire and the suitability of the SIGA-PHS for each. The SIGA-PHS is a multi-sensor device with a wider range of fire sensing capabilities than single sensor detectors. The SIGA-PHS is best suited for detecting slow, smoldering fires such as wood pyrolysis, smoldering cotton, and n-heptane. The supplemental information provided by the integral fixed-temperature heat sensor also makes the SIGA-PHS very suitable for detecting the other types of fire.

SIGA-PHS Applications

Type of Fire	Suitability of SIGA-PHS
Open Wood	Very Suitable
Wood Pyrolysis	Optimal
Smoldering Cotton	Optimal
PU Foam	Very Suitable
n-Heptane	Optimal
Liquid Fire without Smoke	Very Suitable

Intelligent 4D Multisensor Smoke Detector (SIGA-IPHS)

The table below lists six standard types of fire and the suitability of the SIGA-IPHS for each. The SIGA-IPHS is a multi-sensor device with a wider range of fire sensing capabilities than single sensor detectors. The SIGA-IPHS contains ionization and photoelectric smoke sensors as well as a $\Delta 65^{o}$ F ($\Delta 35^{o}$ C) above ambient temperature heat sensor. This combination of sensors in a single detector allows the device to detect slow, smoldering fires such as wood pyrolysis and smoldering cotton and fast, flaming fires such as open wood and n-Heptane fires.

SIGA-IPHS Applications

Type of Fire	Suitability of SIGA-IPHS
Open Wood	Optimal
Wood Pyrolysis	Optimal
Smoldering Cotton	Optimal

PU Foam	Optimal
n-Heptane	Optimal
Liquid Fire without Smoke	Very Suitable

Avoidance of False Alarms

Smoke detectors are sensitive to a number of environmental factors (other than smoke) which may inadvertently activate the detectors. Careful consideration of the environment in which a detector is installed will minimize unwanted detector activation (nuisance alarms). Listed below are some common sources of false alarms to be considered when locating smoke detectors.

- Cooking Equipment
- Welding, Cutting, and Industrial Processes
- Chemical Fumes
- Dust
- Engine Exhaust
- Vibration
- Excessive Airflow
- Lightning and Power Outages
- Radio Frequency Transmissions
- Steam and Moisture

Note: Signature Series smoke detectors provide automatic environmental compensation, which reduces the occurrence of false alarms by allowing sensing elements to adapt to long-term environmental changes, caused by dirt, smoke, temperature, and humidity.

Spacing of Smoke Detectors

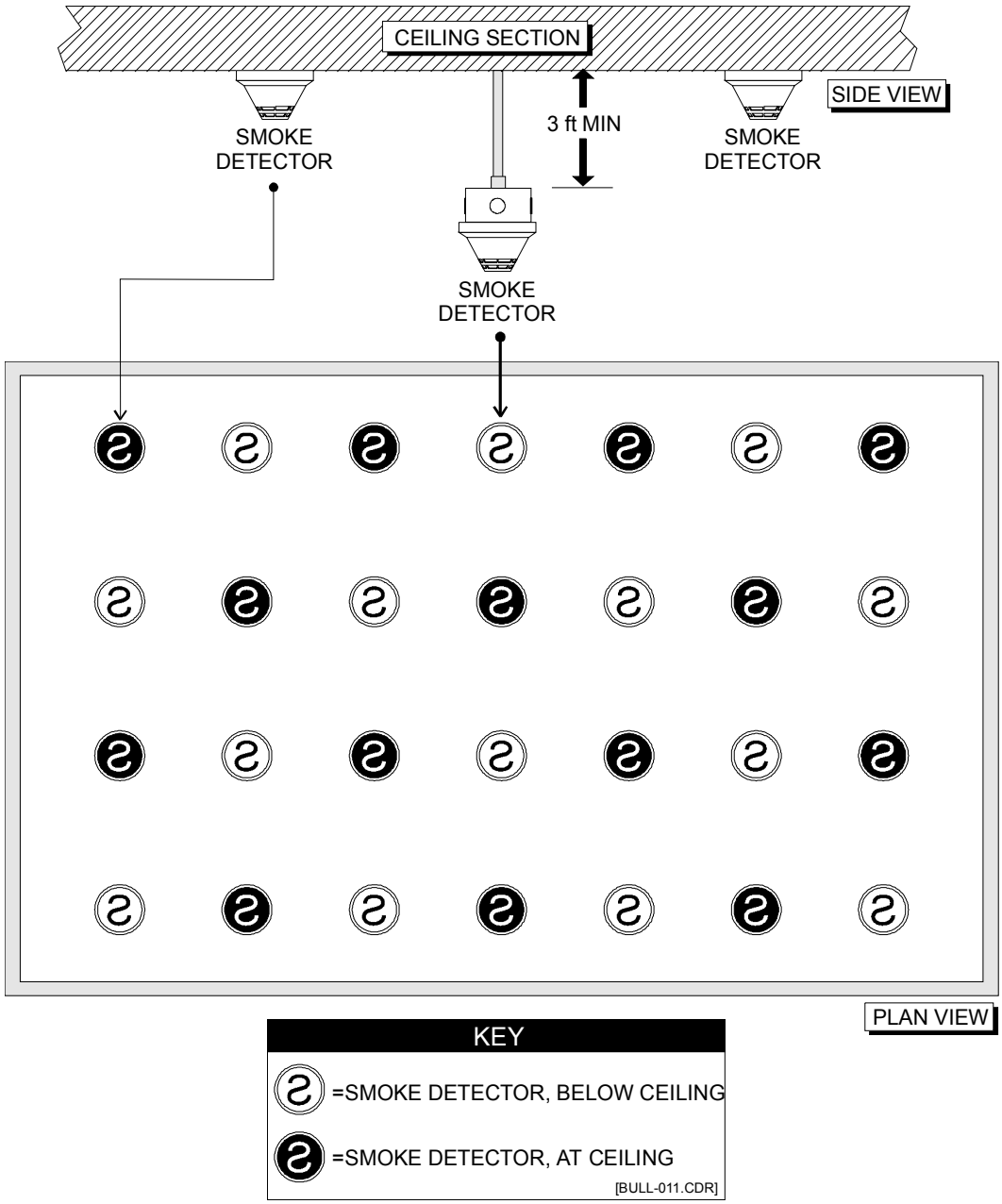
The spot type smoke detector spacing recommendation of 30 ft (9.1 m) is based upon the detector installation on a smooth ceiling which is 10 ft (3 m) high. Detector coverage is typically represented as a square, because most structures have flat sidewalls. Like spot type heat detectors, smoke detector coverage covers a circle whose radius is 0.7 times the listed spacing. Since all of the area within the detector's circle of coverage is suitable for detecting smoke from fire, the shape and dimensions of the detector coverage "square" may be modified. Note that, although the coverage "square" is a "rectangle," the coverage area is within the overall detector circle coverage.

Note: Unlike heat detectors, smoke detectors are not given a listed spacing. It is recommended that smoke detectors be installed on S = 30-ft (9.1 m) centers, on smooth ceilings. NFPA 72, National Fire Alarm Code contains additional information regarding spacing adjustments.

When installed on the ceiling, spot type detectors must be located a minimum of 4 in (10cm) from sidewalls. When installed on sidewalls, the detector must be located between 4 in (10cm) and 12 in (30cm) from the ceiling, unless detectors are specifically positioned to counter the effects of ceiling construction or stratification.

Stratification

Stratified air within a room may impede smoke reaching the detector. To improve detection system response in situations where stratification exists, additional detectors may be installed on sidewalls at elevations below ceiling level an shown below.



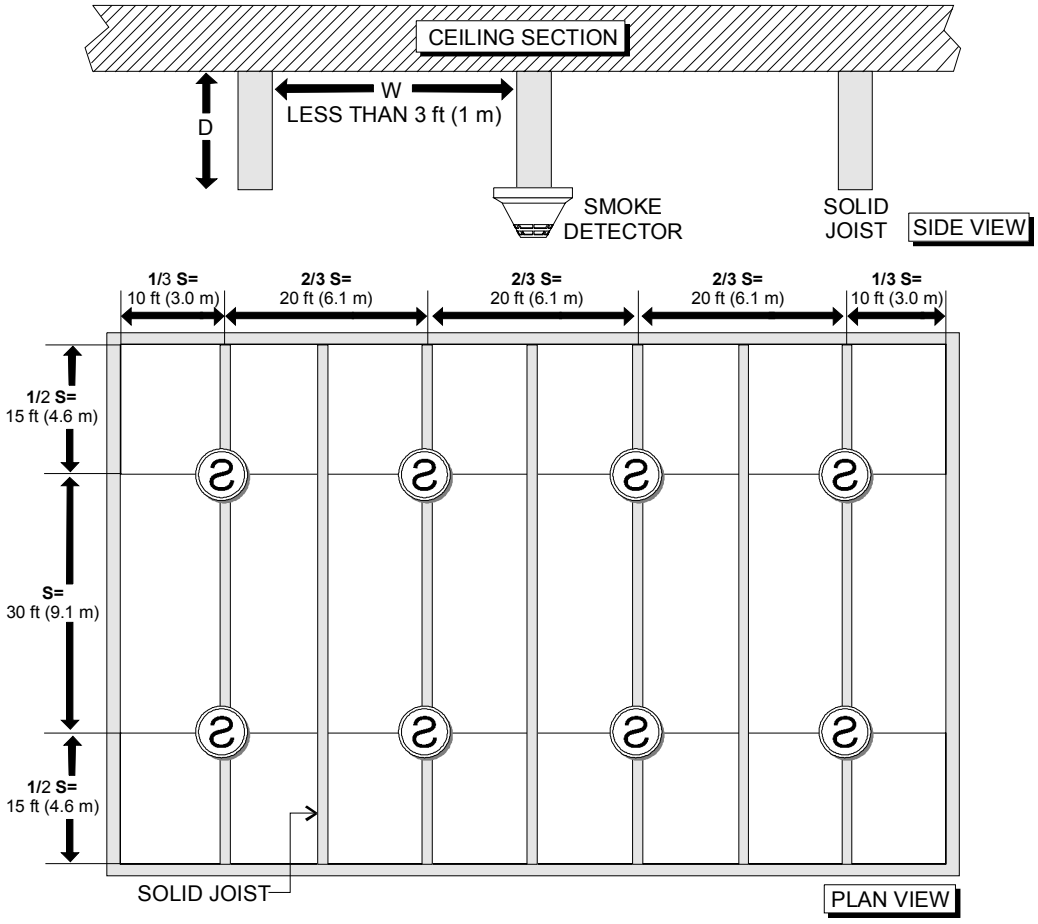
Smoke Detector Compensation for Stratification

Partitions

Partitions extending from the floor to within 18 in. (46cm) of the ceiling do not influence smoke detector spacing. Partitions closer than 18 in (46cm) to the ceiling may require modification of smoke detector spacing.

Exposed Solid Joists

Exposed solid ceiling joists may impede the flow of smoke to detectors. When spacing spot type smoke detectors, a joist is defined as any solid member extending 8 in (20cm) or more down from the ceiling and spaced less than 3 ft (1cm) apart. Note that this definition differs from the one used in locating spot type heat detectors. The spacing of smoke detectors shall be reduced by 33% in the direction perpendicular to the joist. The detectors must be mounted on the bottom of the joists.

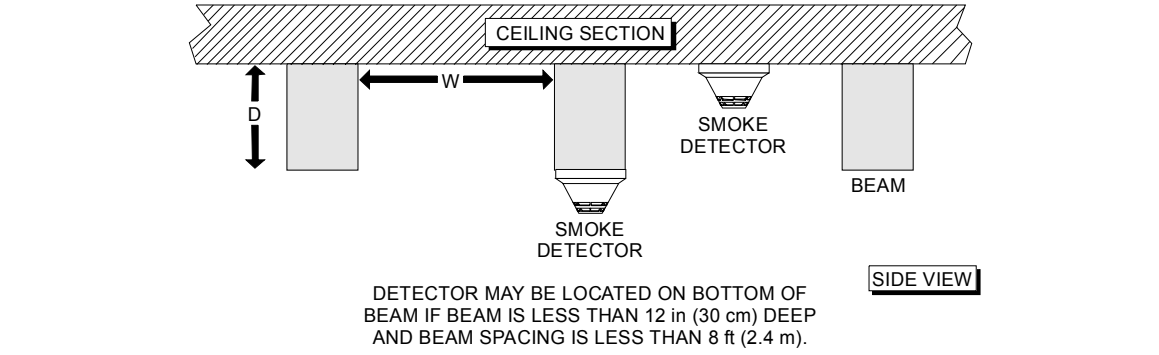


KEY	NOTES
=SMOKE DETECTOR S =RECOMMENDED DETECTOR SPACING **S =30 ft (9.1 m)** FOR SIGNATURE SERIES SMOKE DETECTORS D =DEPTH OF JOIST W=JOIST SPACING	1. JOISTS LESS THAN 8 in (20 cm) DEEP ARE CONSIDERED FLAT CEILINGS. SMOKE DETECTORS MUST BE MOUNTED ON BOTTOM OF JOISTS. 2. SPACING PERPENDICULAR TO JOISTS DEEPER THAN 8 in (20 cm) MUST BE REDUCED BY 1/3 OF LISTED SPACING. [BULL-012.CDR]

Smoke Detector Spacing - Solid Joist Construction

Exposed Beams

Beams are defined as any members extending 8 in (20cm) or more down from the ceiling and spaced more than 3-ft (1m) apart. Note that this definition differs from the one used in locating spot type heat detectors. The spacing of smoke detectors shall be reduced in the direction perpendicular to the beam. Detectors may be mounted on the bottom of the beams that are less than 12 in (30cm). If the beams are greater than 18 in (46cm) deep, each bay created by the beams must have at least one detector mounted on the ceiling.



KEY

S =SMOKE DETECTOR

S =RECOMMENDED DETECTOR SPACING

S =30 ft (9.1 m) FOR SIGNATURE SERIES SMOKE DETECTORS

D =DEPTH OF BEAM W=BEAM SPACING

[BULL-013.CDR]

NOTES

1. BEAMS LESS THAN 8 in (20 cm) DEEP ARE CONSIDERED FLAT CEILINGS. SMOKE DETECTORS MUST BE MOUNTED ON BOTTOM OF BEAMS.
2. NO DEFINITE SPACING REDUCTION SPECIFIED BY CODE FOR BEAMS DEEPER THAN 8 in (20 cm).
3. IF BEAM DEPTH EXCEEDS 18 in (46 cm) AND BEAM SPACING EXCEEDS 8 ft (2.4 m), DETECTORS MUST BE INSTALLED ON THE CEILING IN EACH BAY.

Smoke Detector Spacing - Beam Construction

Smoke detectors should be mounted on the ceiling within each bay if the ratio of beam depth (D) to ceiling height (H), D/H, is greater than 0.1, and the ratio of beam spacing (W) to ceiling height (H), W/H, is greater than 0.4.

Smoke detectors should be mounted on the bottom of each beam if either the ratio of beam depth (D) to ceiling height (H), D/H, is less than 0.1, or the ratio of beam spacing (W) to ceiling height (H), W/H, is less than 0.4.

$\frac{D}{H} > 0.1$ AND $\frac{W}{H} > 0.4$, then mount the detector on the ceiling.

$\frac{D}{H} < 0.1$ OR $\frac{W}{H} < 0.4$, then mount the detector on the bottom of the beam.

[BULL-014.CDR]

Sloped Ceilings

Rooms with peaked ceilings shall have the first row of detectors placed within 3-ft (1 m) (horizontally) of the ceiling peak. Additional detectors, if required, shall be spaced based upon the horizontal projection of the ceiling and ceiling construction. This modification of spacing for smoke detectors on sloped ceilings is identical to that used for spot type heat detectors.

Rooms with shed ceilings having greater than 1 ft in 8 ft (1m in 8m) shall have the first row of detectors within 3-ft (19m) of the high end of the ceiling. Additional detectors, if required, shall be spaced based upon the horizontal projection of the ceiling and ceiling construction. For roofs having a slope less than 30^{o}, horizontal spacing shall be adjusted according to the height of the peak. For roofs having a slope greater than 30^{o}, horizontal spacing shall be adjusted according to the average sloped ceiling height. This modification of spacing for smoke detectors on shed ceilings is identical to that used for spot type heat detectors.

High Air Movement

The use of spot type smoke detectors in areas of high air movement (greater than 300ft/min [1.5m/sec]) requires a suitable reduction in detector spacing to maintain detector performance. The table below should be used to reduce detector spacing in these areas. The table is not valid for use under floor or ceiling plenum areas, however, the principle of reduced spacing in these high velocity areas applies.

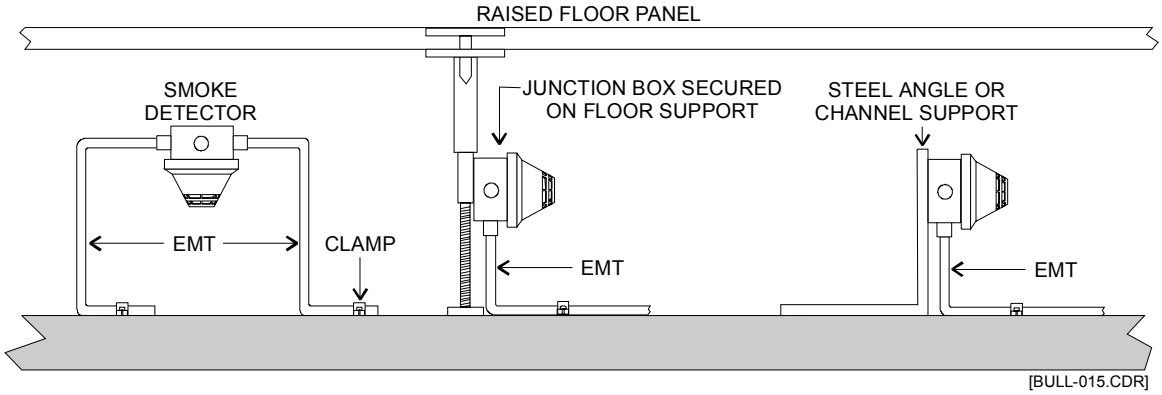
High Airflow Area Detector Spacing Reduction

Minutes per Air Change	Number of Air Changes per Hour	Coverage per Detector
1	60	125 ft^2 (11.25 m^2)
2	30	250 ft^2 (22.50 m^2)
3	20	375 ft^2 (33.75 m^2)
4	15	500 ft^2 (45.00 m^2)
5	12	625 ft^2 (56.25 m^2)

6	10	750 ft^2 (67.50 m^2)
7	8.6	875 ft^2 (78.75 m^2)
8	7.5	900 ft^2 (81.00 m^2)
9	6.7	900 ft^2 (81.00 m^2)
10	6	900 ft^2 (81.00 m^2)

Under Floor Installations

When spot type smoke detectors are installed under raised floors, they are subjected to high air velocities and dust levels. Detectors should be installed base up or base vertical (never down) as shown in the figure below. This minimizes the effects of dirt, dust, and mechanical interference from cabling.



Permissible Smoke Detector Under Floor Mounting

Effects of Heating, Ventilating, and Air Conditioning (HVAC) Systems

Because airflow is critical to the transportation of smoke to the detector location, smoke detectors should never be located closer than 3ft (1m) to an HVAC supply diffuser. Where feasible, detectors should be located to favor the airflow heading for HVAC return grills. Do not rely on the operation of the HVAC system when spacing smoke detectors.

Air Duct Smoke Detector Applications

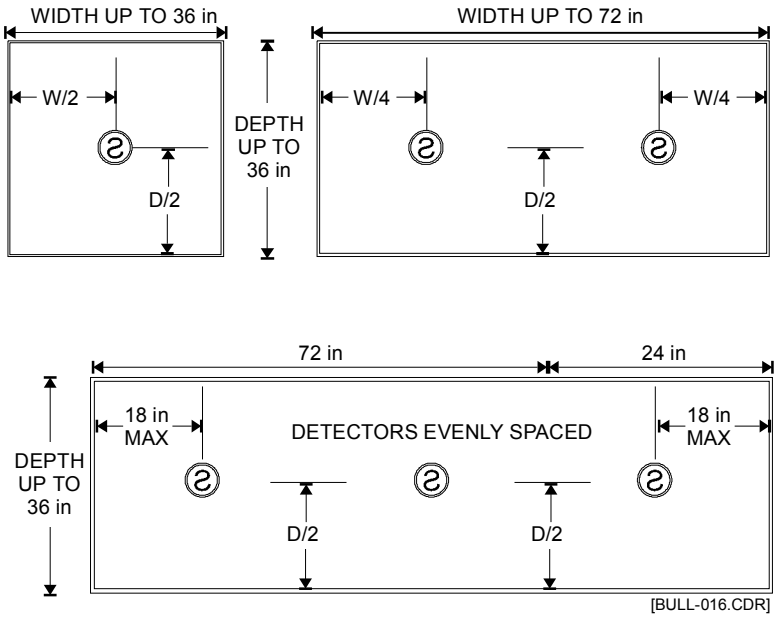
Controlling Smoke Spread

Note: Smoke detectors placed in air ducts or plenums are not substitutes for open area smoke detectors.

Spot type smoke detectors listed for the required air velocity may be installed up to 12 in (30cm) in front of or behind the opening in return ducts, and spaced per the table below. Refer to the figure below. When the duct height exceeds 36 in (91cm), the duct width detector placement guidelines in the table below shall also be used for duct height detector placement when ducts are higher than 36 in (91cm) to form a 2-dimensional matrix of detectors within the duct opening.

Location of Spot Type Detectors in Return Air Duct Openings

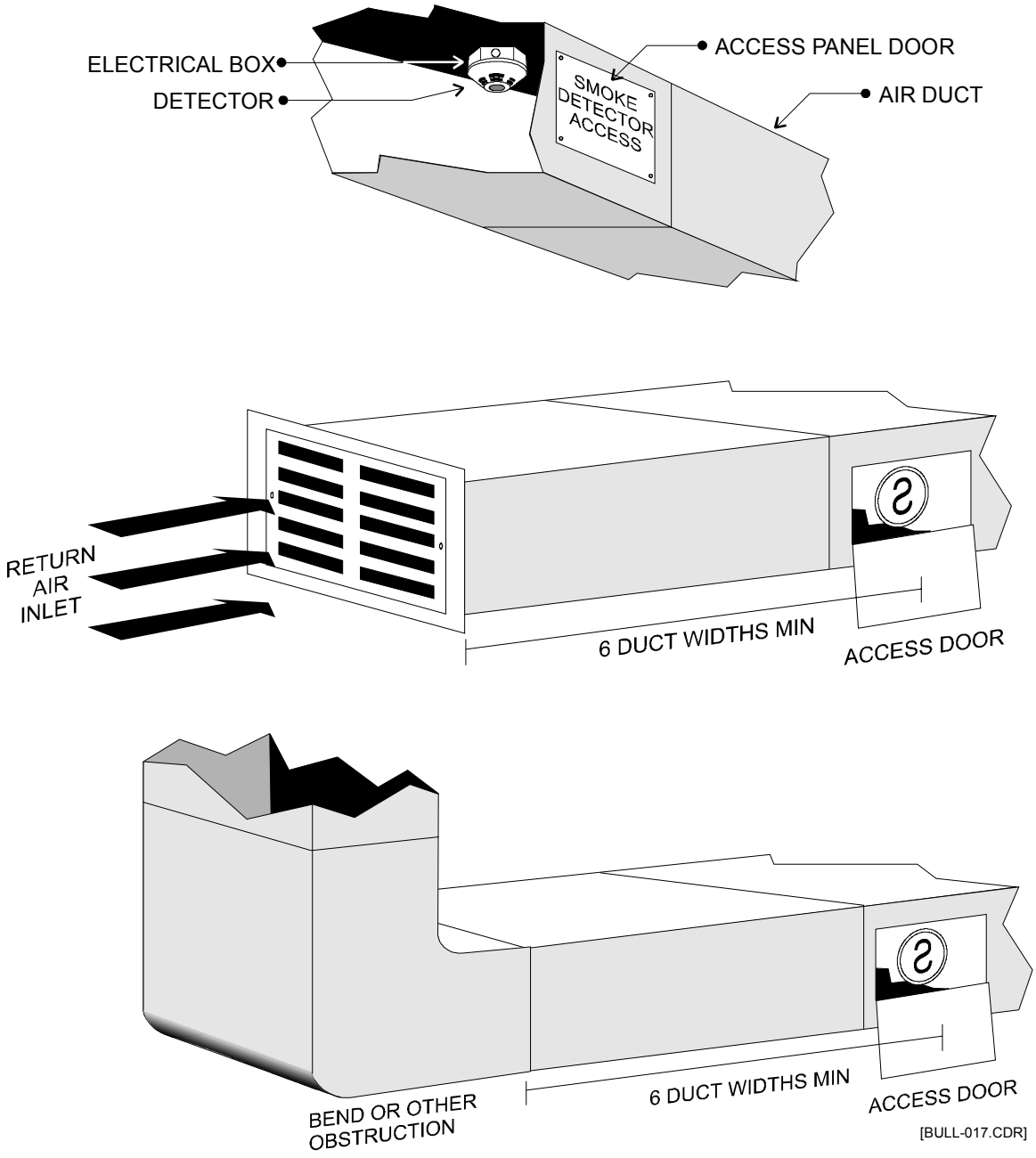
Duct Width	Detector Placement
Up to 36 in (91cm)	One detector centered in the duct opening
Up to 72 in (183cm)	Two detectors located at the ¼ points of the duct opening
Over 72 in (183cm)	One additional detector for each full 24 in. (61cm) of duct opening



Smoke Detector Spacing in Return Ducts

In order to obtain a representative sample of the air in a supply duct, detectors should be located between 6 and 10 duct widths downstream of grills, bends, or other obstructions in the duct. All duct detector

locations shall be permanently marked and shall be accessible for cleaning and maintenance.

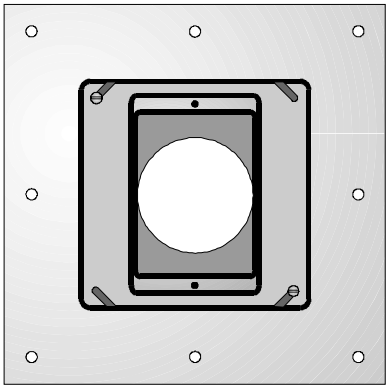


Smoke Detector Location in Return Ducts

Duct Detector Mounting Plate (SIGA-DMP)

The Duct Detector Mounting Plate, model SIGA-DMP, is a 7 in (17.8cm) square mounting plate with 4 in (10.2cm) square electrical

box used to directly mount a Signature Series smoke detector inside an air duct. The SIGA-DMP provides screws for mounting the detector base and includes a rubber gasket that forms an airtight seal between the mounting plate and the air duct wall.



[BULL-018.CDR]

The SIGA-DMP may installed in ducts that have a maximum width of up to 36 in (91.4cm) and a maximum height of up to 36 in (91.4cm).

Compatible smoke detectors include the SIGA-PS, SIGA-PHS, and SIGA-IPHS. Compatible bases include the SIGA-SB, SIGA-RB, and SIGA-IB. The table below lists compatible smoke detectors and the acceptable air velocity range for each.

SIGA-DMP Compatible Smoke Detectors

Model	Acceptable Air Velocity Range
SIGA-PS	0 - 5,000 ft/min (0 - 25.39 m/s)
SIGA-PHS	0 - 5,000 ft/min (0 - 25.39 m/s)
SIGA-IPHS	0 - 5,00 ft/min (0 - 2.54 m/s)

The SIGA-DMP may be installed in any of 3 possible configurations. Refer to the next figure.

Option #1

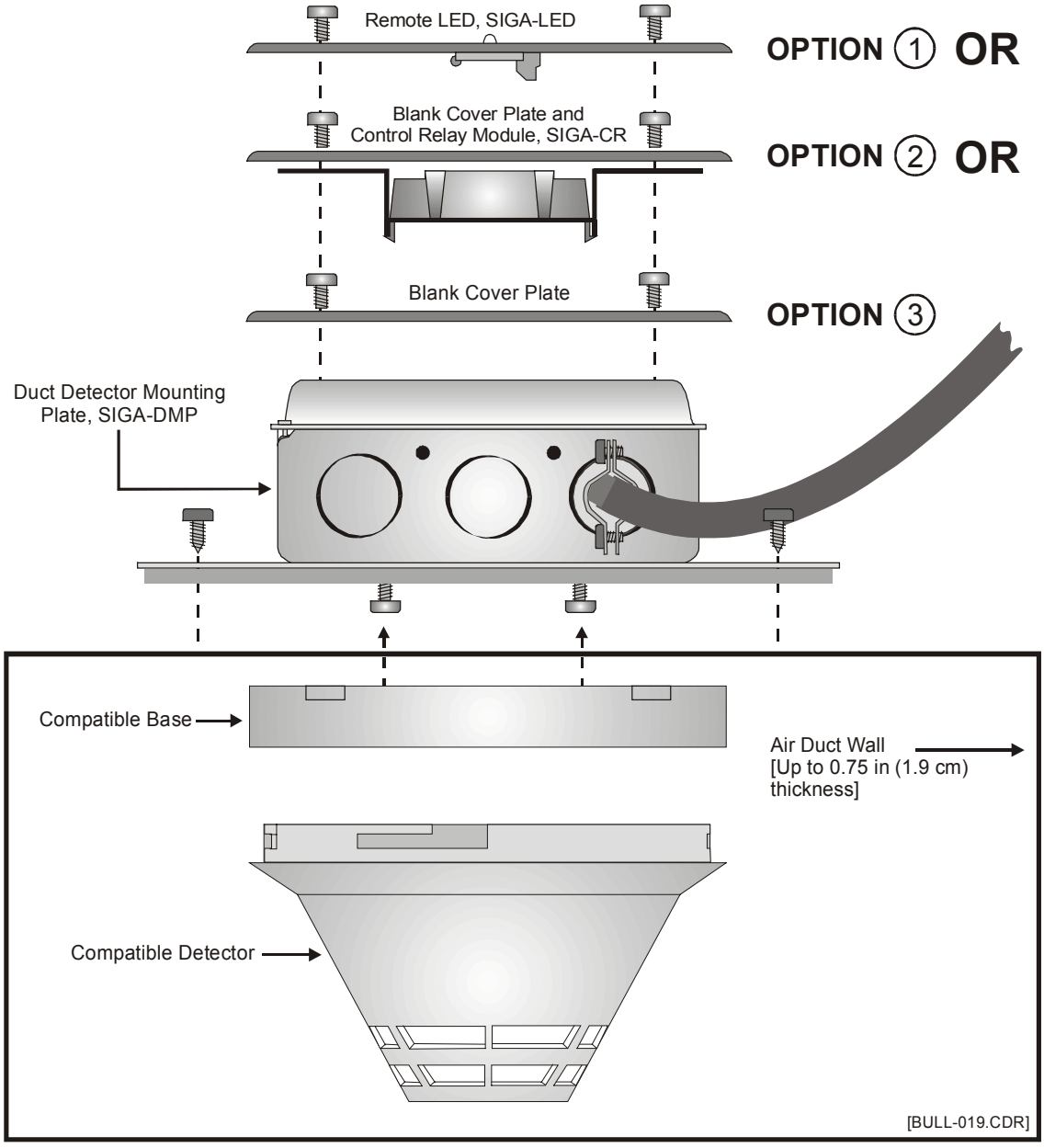
In applications where the SIGA-DMP is mounted in an easily accessible, clearly visible location on the air duct, a remote LED (model SIGA-LED) may be mounted to the SIGA-DMP to indicate Normal and Alarm conditions of the smoke detector.

Option #2

In applications where a control relay module (model SIGA-CR) is mounted directly to the SIGA-DMP, a remote LED (model SIGA-LED) must be mounted at a remote location to provide indication of normal and alarm conditions of the smoke detector.

Option #3

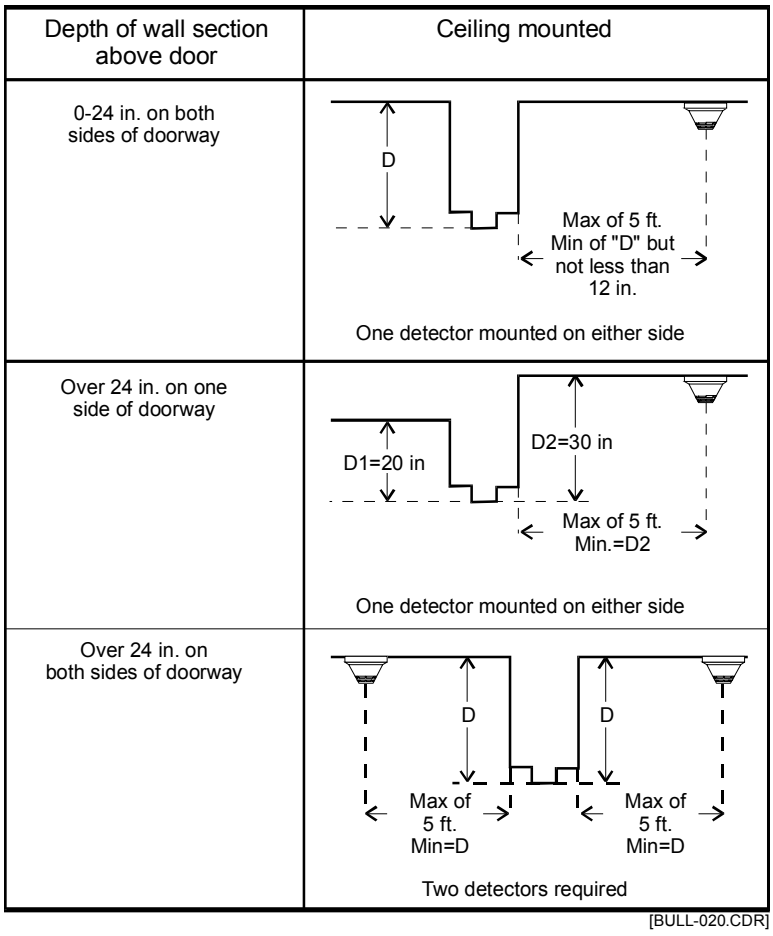
In applications which the SIGA-DMP is not mounted in a clearly visible location on the air duct, a remote LED (model SIGA-LED) must be mounted at a remote location to provide indication of normal and alarm conditions of the smoke detector. A blank cover plate is installed at the SIGA-DMP.



SIGA-DMP Installation Options

Door Release Service

When spot type smoke detectors are installed to detect smoke coming from either side of a doorway in order to release the door(s), smoke detectors shall be installed according to the figure below.



Smoke Detector Locations for Door Release Service

Initial Installation Testing

To do an initial installation test:

1. Visually inspect each detector and verify it is installed in the correct location. Make sure it will not be adversely affected by factors not apparent on the plans.
2. Remove the detector from its base and verify that the proper detector address, trouble signals, and messages are reported.
3. Activate smoke detectors using a chemical smoke aerosol spray (Smoke Tester by Home Safeguard, Inc. is recommended) or smoke generator.
4. Activate rate-of-rise heat detectors using a heat gun.
5. Verify that adequate airflow is available for air duct detectors per the installation instructions. Verify that the detector address and message are correct.
6. If wired for Class A operation, verify operation with each data circuit disconnected.
7. Place a ground on the data circuit and verify operation of ground fault detection circuitry.
8. Run a system detector sensitivity report on all detectors and verify that readings fall within acceptable limits.

Sensitivity Readings

The control system to which these detectors are connected is capable of interrogating each detector to determine its sensitivity. The system can provide a hardcopy of the results of sensitivity testing if a printer is installed. The table below lists the acceptable range of sensitivity for Signature Series smoke and heat detectors.

Acceptable Sensitivity Ranges as Reported by the Control Panel

Model	Detection Element(s)	Factory-Assigned Sensitivity	Pre-Alarm Point (%obsc./ft)	Adjustable Alarm Point Setting (%obsc./ft)
SIGA-IS	Ionization	1.6% obsc./ft	75% of Alarm Setting	0.7. 1.0, 1.2, 1.4, 1.6
SIGA-PS	Photoelectric	3.5% obsc./ft	75% of Alarm Setting	1.0, 2.0, 2.5, 3.0, 3.5
SIGA-PHS	Photoelectric, Fixed Temperature	3.5% obsc./ft, 135° F (57° C)	75% of Alarm Setting	1.0, 2.0, 2.5, 3.0, 3.5
SIGA-IPHS	Ionization, Photoelectric, Above Ambient Temp	3.5% obsc./ft, 65° F (35° C) above ambient temperature	75% of Alarm Setting	1.0, 2.0, 2.5, 3.0, 3.5
SIGA-HFS	Fixed-Temperature	135° F (57° C)	N/A	N/A
SIGA-HRS	Rate-of-Rise, Fixed-Temperature	15° F/minute, 135° F (57° C)	N/A	N/A

Routine Maintenance

Detectors shall be tested on a routine basis satisfactory with the Authority Having Jurisdiction, typically once every 6 months.

1. Verify detector operation, wiring integrity, and control panel operation sequences specific to that detector, if any.
2. Activate smoke detectors using a chemical smoke aerosol spray (Smoke Tester by Home Safeguard, Inc. is recommended) or smoke generator.
3. Activate rate-of-rise heat detectors using a heat gun.
4. Run a system detector sensitivity report on all detectors and verify that readings fall within acceptable limits. Detectors too close to the alarm threshold should be cleaned according to the manufacturer's instructions.

Detector Cleaning Procedure

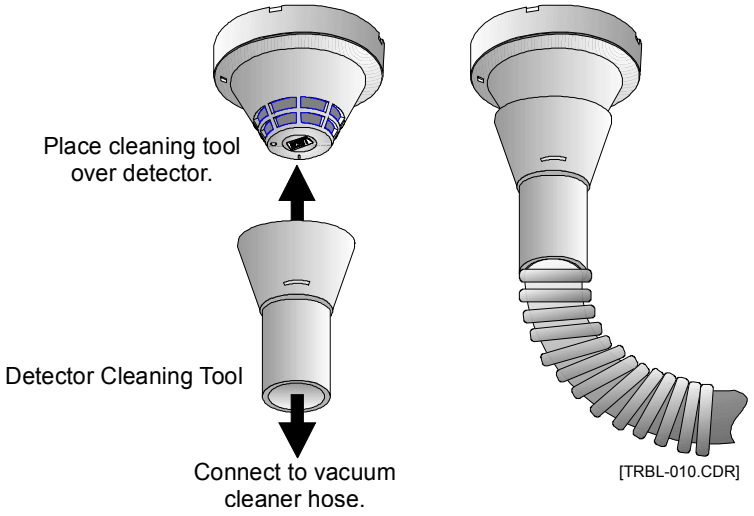
Recommended Preventive Maintenance Schedule

Component	Testing Interval	Testing Procedure
SIGA-HFS SIGA-HRS	Semi-Annually	1. Visually inspect the heat detector. Verify Green LED flashing. 2. Put the detector/zone in TEST mode. 3. Hold the heating device (1200- to 1500-watt commercial hair blow dryer recommended) approximately 1-inch from the detector, directed towards the heat entry slots. CAUTION: Do not use excessive heat for too long or permanent detector damage may result. 4. Turn the blower on at its highest setting. The detector should alarm within 10 to 15 seconds. 5. Verify that a detector activation indication is listed on the printer.
SIGA-IS SIGA-PS SIGA-PHS SIGA-IPHS	Annually	1. Visually inspect the smoke detector. Verify Green LED flashing. 2. Put the detector/zone in TEST mode. 3. If a detector functional test is required, use the Home Safeguard Smoke Detector Tester with a 1490 adapter/tube accessory. Test per instructions stated on the Home Safeguard can. 4. Verify that a detector activation indication is listed on the printer. 5. Run a detector sensitivity and compensation report.

Clean the detectors using a conventional vacuum cleaner equipped with the Detector Cleaning Tool (P/N SIGA-ST). The tool connects to a 1.5-inch (3.8 cm) suction hose/extension tube. The tool removes loose dust and debris by creating a high velocity vortex scrubbing action around the detector.

To clean the detector:

1. Disable the detector/zone to prevent false alarms.
2. Use conventional vacuum cleaner brush to remove visible cobwebs, etc. from the immediate area of the detector.
3. With the Detector Cleaning Tool connected to the vacuum, place the tool over the detector head for approx. 1 minute while rotating back and forth. See the figure below.
4. Check and record the detector's dirty level reading to verify the effectiveness of cleaning.



Detector Cleaning Tool

Recording Detector Sensitivity and Available Compensation

Signature Series environmental compensation circuits and the alarm algorithm used in Signature Series detectors guarantee that a detector's sensitivity setting is maintained as long as a detector has compensation headroom. When the detector reaches 80% dirty, the system generates a maintenance alert indicating the detector should be cleaned in the near future. When the detector reaches 100% dirty, a detector trouble condition is annunciated.

To properly judge the effectiveness of the detector cleaning process, you must observe the effect cleaning had on the detector's dirtiness level. This can be accomplished using the SIGA-PRO Service Tool. Follow the procedure supplied with the SIGA-PRO.

When the SIGA-PRO is not available, you will not be able to verify dirtiness levels after cleaning. In this case, clean the detector and operate for a minimum of two hours, then:

Restart the loop controller.

1. All maintenance indications will restore if the detectors have been cleaned properly.
2. Run the detector sensitivity routine to print a list of detector sensitivity and compensation readings.