



Beam Detection
others look up to

OPTICAL BEAM SMOKE DETECTORS

This training material provides information to assist the Fire System Designer and Installer in achieving a successful Optical Beam Smoke Detection installation

The appropriate local installation standards and legislation in effect at the time of installation must be adhered to and take precedence over any statements made or implied by this training material.

Information provided is from the current Codes and Standards as it relates to Smoke Beam Detection

FFE Ltd cannot take responsibility for the installation (beam positioning and mounting), commissioning or maintenance of products.



Beam Spacing

17.7.3.1.1 The location and spacing of smoke detectors shall be based upon the anticipated smoke flows due to the *plume and ceiling jet produced by the anticipated fire*, as well as any pre-existing ambient airflows that could exist in the protected compartment.

NFPA 72-2016



Beam Spacing

A17.7.3.1 Except in the case of smoldering, low-energy fires, all smoke detectors, regardless of the type of technology, usually rely on the *plume and ceiling jet produced by the fire to transport the smoke upward and across the ceiling to the* detector, sample port or *projected sensing light beam* and, in case of spot type detectors, sufficient flow velocity is attained to overcome the flow resistance into the sensing chamber, the detector responds with an alarm signal. Detectors are usually mounted at the ceiling plane to take advantage of the flow provided by the plume and the ceiling jet. A hot, energetic fire produces large plume velocities and temperatures and hot fast ceiling jets. This minimizes the time it takes for the smoke to travel to the detector. A smoldering fire produces little, if any, plume and no appreciable ceiling jet. Far more time elapses between ignition and detection under this circumstance.

NFPA 72-2016

Beam Spacing

A17.5.2 The generally accepted principle is that the ceiling jet is approximately *10 percent of the distance* from the base of the fire to the ceiling.

NFPA 72-2016

Beam Spacing

- UL listed products must comply with NFPA 72 and 92B
- Ensure clear line of sight between Detector and Reflector – it is recommended at least 20 inch (51cm) radius of clear space be maintained around the center of the beam path
- Position beam as high as possible, but with a minimum distance of 20 inches (51cm) from Detector to ceiling for reflective and 12 inches (30.5 cm) from Detector to ceiling for End to End.
- For installations complying with UL268/NFPA72 and 92B, *the maximum distance of Detector and Reflector from the ceiling must be 10% of the distance between floor and ceiling*

NFPA 72 2016 17.7.3.7.1



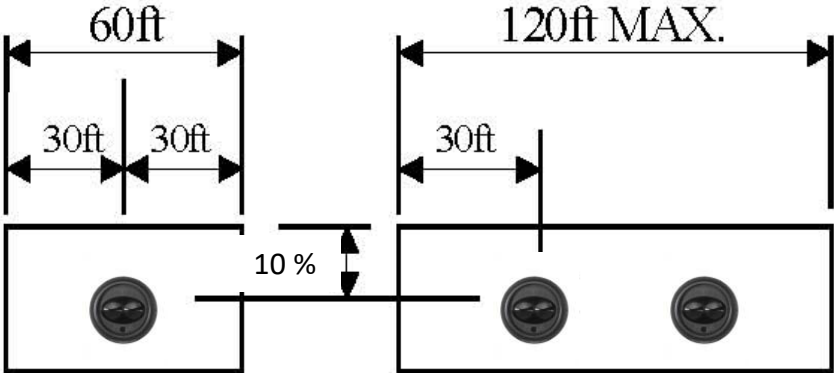
Beam Spacing

A17.7.3.7 On smooth ceilings, a spacing of not more than 60 ft. (18.3 m) between projected beams and not more than one-half (1/2) that spacing 30 ft. (9.14m) between the projected beam and a side wall (wall parallel to the beam travel) should be used as a guide. Other spacing should be determined based upon ceiling height, airflow characteristics and response requirements. In some cases, the light beam projector is mounted on one end wall, with the light beam receiver mounted on the opposite wall. However it is also permitted to suspend the projector and receiver from the ceiling at a distance from the end walls not exceeding one-quarter (1/4) the selected spacing (15 ft.) (4.57m).

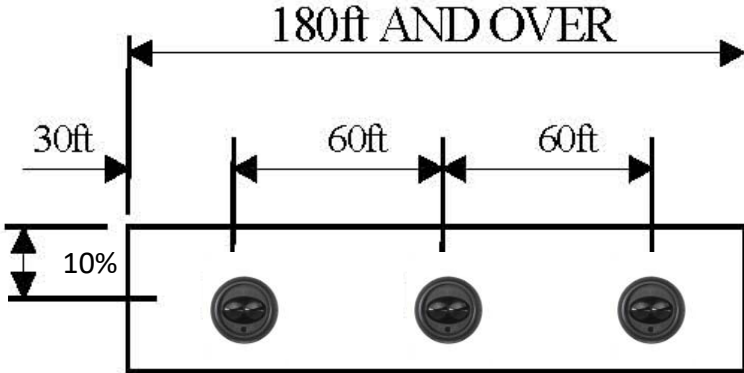
NFPA 72-2016

Beam Spacing

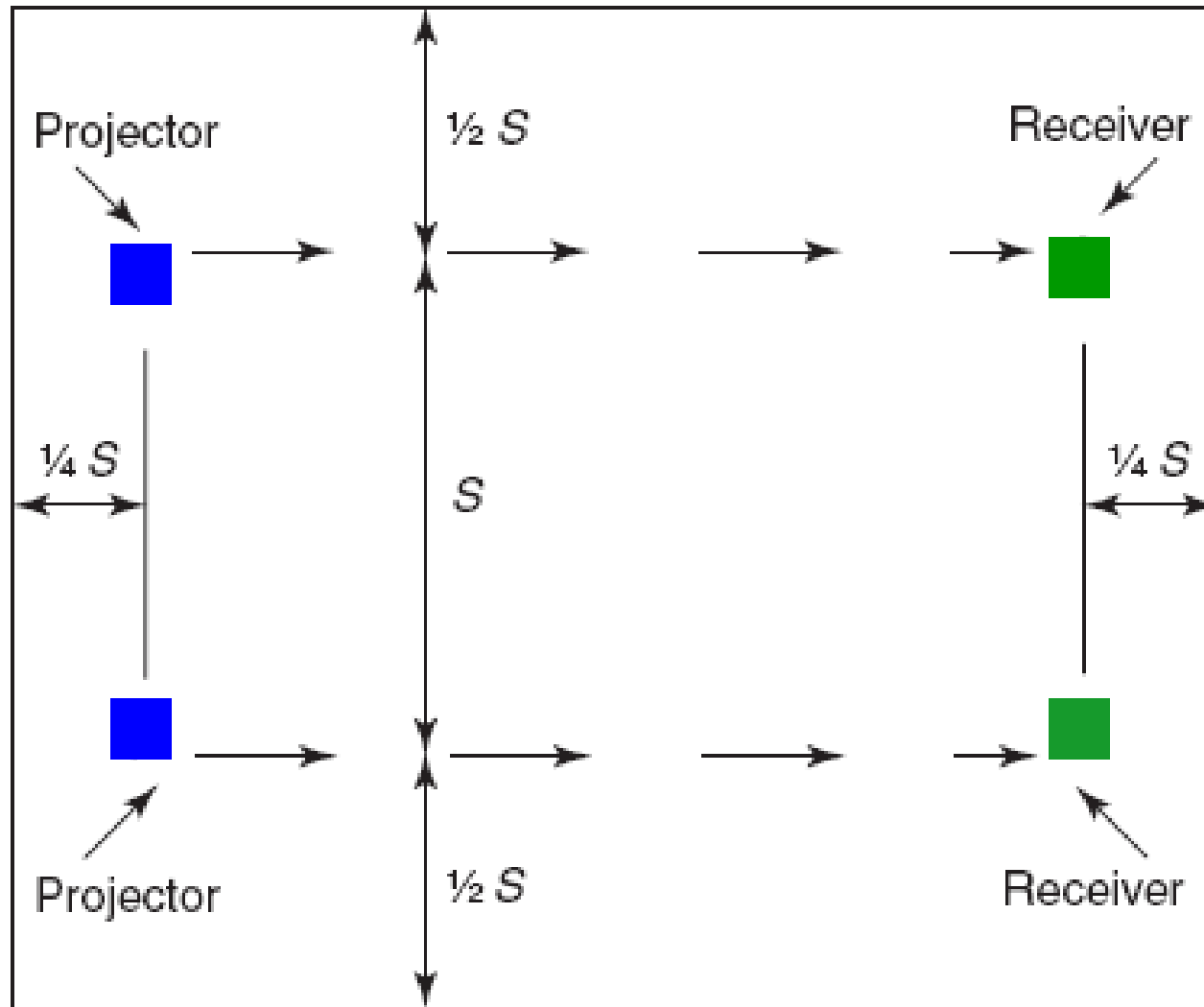
SINGLE BEAM



MULTIPLE BEAMS



Beam Spacing



A.17.7.3.7
NFPA 2016

S = Selected detector spacing



Which Code to Follow

NFPA 72 – Smoke Detection

NFPA 92B – Smoke Control

NFPA 92B

4.5.1.2 For large spaces where smoke stratification can occur, one of the following detection means *shall* be used:

- (1) Beam-type smoke detector(s) aimed at an upward angle to intersect the smoke layer regardless of the level of stratification
- (2) Horizontally mounted beam-type smoke detector(s) located at the ceiling with additional beam-type smoke detector(s) located at other levels in the volume to cover any identified unconditioned (dead air) spaces
- (3) Horizontally mounted beam-type smoke detector(s) located below the lowest expected level of stratification

NFPA 92B

A.4.5.2 The purpose of using an upward beam to detect the smoke layer is to quickly detect the development of a smoke layer at whatever temperature condition exists. One or more beams should be aimed at an upward angle to intersect the smoke layer regardless of the level of smoke stratification. More than one beam smoke detector *should* be used. Manufacturer's recommendations should be reviewed when using these devices for this application. Devices installed in this manner can require additional maintenance activity.

NFPA 92B



NFPA 92B

A.4.5.2 The purpose of using horizontal beams to detect the smoke layer at various levels is to quickly detect the development of a smoke layer at whatever temperature condition exists.

One or more beam detectors are located at the ceiling. Additional detectors are located at other levels lower in the volume. The exact positioning of the beams is a function of the specific design but should include beams at the bottom of any identified unconditioned (dead-air) spaces and at or near the design smoke level with intermediate beam positions at other levels.

NFPA 92B



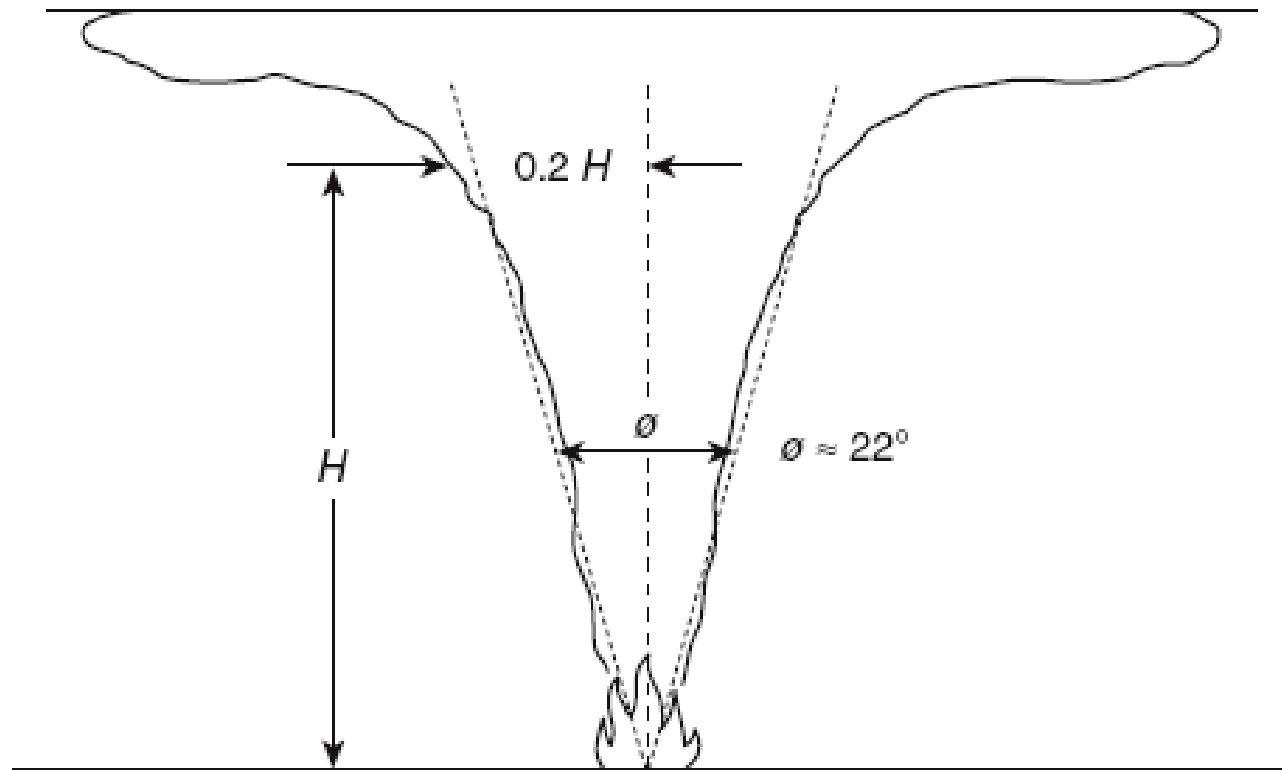
NFPA 92B

A.4.5.2 The purpose of using horizontal beams to detect the smoke plume is to detect the rising plume rather than the smoke layer.

For this approach, an arrangement of beams close enough to each other to assure intersection of the plume is installed at a level below the lowest expected stratification level.

The spacing between beams has to be based on the narrowest potential width of the plume at the level of detection.

NFPA 92B



NFPA 72 2016 - B.4.9.1 The Plume Divergence of an Unconstrained Fire

When to use a Optical Beam Smoke Detector

Ceiling Height

Spot Detector	=	up to 45 ft. (13.7m)
Aspirating detector	=	41 - 60 feet (12.5 – 18.3m)
Beam Detectors	=	No Height Limit

FFE's recommendation is:

*If you have a ceiling height above 65 ft. (19.8m) –
the smoke stratification layer needs to be addressed.
Additional beam detectors might be necessary at lower levels*

*Beams need to be in the smoke stratification layer

Based upon Best Practices

NFPA 72 - 2013

