

FLAME DETECTOR SELECTION GUIDE

APPLICABILITY & EFFECTIVITY

Effective for all Models 3100, 3200, 3300 and 3600 Detectors manufactured after June 1, 2010.

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SELECTING A FLAME DETECTOR

Planning and installing flame detectors requires consideration of the nature of the fire, the protected area, environmental conditions, detector capabilities and limitations and user expectations. For instance, is it more important to select a detector that alarms a few seconds faster or a detector that has superior immunity to false alarms? Is it more important that the detector can detect a wide range of fuels or shall it focus on only one fuel?

1.1 DEFINING THE APPLICATION

You need to consider the following:

- All fuels that present a fire hazard
- Location of potential fires
- Minimum detection distance required
- Maximum detection distance required
- Speed of response
- All sources of nuisance radiation
- Environment conditions

1.2 FUEL TYPES

You will need to know the following:

- Hydrocarbon or non-organic fuel types (i.e. Methane vs. Hydrogen or Silane)
- Liquid or gases fuel source (flame detectors can detect liquid fires at a greater distance)
- Potential sources of false alarms (welding operations, reflected sunlight, extreme weather, etc depending upon type of flame detector)

1.3 FIRE SIZE

- Detector sensitivity and range are related to fire size. Performance is normally specified in relation to a standard 1 square foot gasoline pan fire for liquids, plume flame with 18" height and 8" width for gases, and defined by weight, size and pre-ignition configuration for solids
- Typical detection ranges based upon fire size are as follows:

Fuel	Fire Size	UV/IR	UV/IR/Vis	IR3	Multi IR
Gasoline	1 sq ft pan fire	50 ft	80 ft	215 ft	215 ft
Heptane		50 ft	80 ft	215 ft	215 ft
JP5		37 ft		150 ft	150 ft
Kerosene		37 ft	75 ft	150 ft	150 ft
Ethanol		25 ft		135 ft	135 ft
IPA		25 ft		135 ft	135 ft
Hydrogen	18" Plume	16 ft	15 ft	-	160 ft
Silane	12" Plume	15 ft	50 ft	-	-

1.4 CURRENT MODEL RANGE AND CHARACTERISTICS

Model Number *	Detector Type	Max. Detection Range ** ft (m)	Response Time (Typical)	Description
3600-U-UB	UV	50 (15)	5 sec.	UV detector for indoor applications - detects organic and inorganic flames.
3600-L-LB	UV/IR	50 (15)	5 sec. (150msec.)	Dual UV/IR for detection of organic and inorganic flames for indoor and outdoor applications.
3600-L4-L4B	UV/IR	50 (15)	5 sec.	Dual UV/IR for detection of hydrocarbon fires.
3600-R	IR	50 (15)	5 sec.	Single IR Detector for hydrocarbon fires - indoor applications.
3600-I	Triple IR (IR3)	215 (65) 200 (60)	5 sec.	Triple IR (IR3) offers two to three times the detection distance of single IR or UV/IR detectors and the highest immunity to false alarms. This model includes heated optics, HART and complies with SIL-2.
3600-M	Multi IR	H2 – 100 (30) HCs – 215 (65)	5 sec.	Special design for detection of invisible Hydrogen flames and hydrocarbon fires.
3100	UV/IR/Vis	80 (24)	3 sec.	UV/IR and Visible for indoor or outdoor hydrocarbon, hydrogen, silane, inorganic 120° cone of vision
3200	UV/IR	40 (12)	3 sec.	UV/IR for semiconductor wet bench
3300	UV/IR	40 (12)	3 sec.	UV/IR hydrocarbon indoors

* All models, except those noted below, have automatic and manual Built-in-Test (BIT) to verify proper operation and lens cleanliness.

Models without BIT: 3600-U, 3600-L and 3600-L4

** Max detection range based upon a 1ft² (0.1m²) gasoline / heptane pan fire.

Note: All 3600 Models incorporate heated optics, HART and comply with SIL-2 requirement.

1.5 COMPARISON OF VARIOUS TYPES OF FLAME DETECTORS

Each of the flame detector families uses one or more of the Ultraviolet (UV) and/or Infrared (IR) techniques. However, each family is recommended only for specific applications, usually determined by evaluating to what extent false alarms could create problems.

Detector Type	Applications	Advantages	Disadvantages
Triple IR (IR3)	<ul style="list-style-type: none"> Hydrocarbon fires Indoors and outdoors 	<ul style="list-style-type: none"> Moderate speed Highest sensitivity High immunity to false alarms Longer detection range Unaffected by solar radiation 	<ul style="list-style-type: none"> Affected by IR sources only at short range in certain rare fire scenarios
Multi IR	<ul style="list-style-type: none"> Hydrocarbon and Hydrogen fires Indoors and outdoors 	<ul style="list-style-type: none"> As IR3 but with hydrocarbon and hydrogen fire detection 	<ul style="list-style-type: none"> As IR3
Dual Band UV/IR	<ul style="list-style-type: none"> Hydrocarbon, Hydrogen, Silane, Ammonia, other hydrogen-based fuel fires and Metal fires Indoors and outdoors 	<ul style="list-style-type: none"> Moderate speed - Moderate sensitivity Low false alarm rate Unaffected by solar radiation 	<ul style="list-style-type: none"> Affected by specific UV//IR ratio created by false stimuli Blinded by thick smoke, vapors, grease and oil deposits on the detector window
Single I (IR)	<ul style="list-style-type: none"> Hydrocarbon fires Indoors 	<ul style="list-style-type: none"> Moderate speed Moderate sensitivity Unaffected by solar radiation Low cost 	<ul style="list-style-type: none"> Subject to false alarms ((in the presence of flickering IR sources)
Single Ultraviolet (UV)	<ul style="list-style-type: none"> Hydrocarbon, Hydrogen, Silane, Ammonia, other hydrogen-based fuel fires and Metal fires Indoors 	<ul style="list-style-type: none"> High speed Moderate sensitivity Unaffected by solar radiation Unaffected by hot objects Low cost 	<ul style="list-style-type: none"> Subject to false alarms from UV sources (arc welding, electrical sparks, halogen lamps) Blinded by thick smoke, vapors, grease and oil deposits on the detector window
Triple Wavelength	<ul style="list-style-type: none"> Hydrocarbon, Hydrogen, silane and other hydrogen based flames Indoors or outdoors 	<ul style="list-style-type: none"> 120° cone of vision Low false alarm rate Unaffected by solar radiation Multiple fuel types FM & CSFM Approvals 	<ul style="list-style-type: none"> Blinded by deposits on window

1.6 FIRE SIZE AND MAXIMUM DETECTION DISTANCES

The following table lists typical detection distances for different types of Flame Detectors and for a range of fuels.

Fuel	Fire size	3600-I	3600-L-LB	3600-L4-L4B	3600-U-UB	3600-R	3600-M	3100
		IR3	UV/IR	UV/IR	UV	IR	Multi IR	UV/IR/Vis
Gasoline	1 ft ² (0.1m ²) pan fire	215 (65)	50 (15)	50 (15)	50 (15)	50 (15)	215 (65)	75 (22.5)
n-Heptane		215 (65)	50 (15)	50 (15)	50 (15)	50 (15)	215 (65)	80 (24)
Diesel Fuel		150 (45)	36 (11)	36 (11)	36 (11)	36 (11)	150 (45)	-
JP5		150 (45)	36 (11)	36 (11)	36 (11)	36 (11)	150 (45)	-
Kerosene		150 (45)	36 (11)	36 (11)	36 (11)	36 (11)	150 (45)	75 (22.5)
Alcohol (Ethanol)		135 (40)	25 (7.5)	25 (7.5)	36 (11)	25 (7.5)	135 (40)	-
IPA (Isopropyl Alcohol)		130 (40)	25 (7.5)	25 (7.5)	36 (11)	25 (7.5)	130 (40)	-
Methanol		116 (35)	25 (7.5)	25 (7.5)	25 (7.5)	25 (7.5)	116 (35)	-
Methane	20"(0.5m) Plume fire	100 (30)	16 (5)	16 (5)	40 (12)	16 (5)	100 (30)	-
LPG (Propane)		100 (30)	16 (5)	16 (5)	40 (12)	16 (5)	100 (30)	-
Hydrogen		-	16 (5)	-	33 (10)	-	100 (30)	15 (5)
Polypropylene Pellets	8"(0.2m) ? pan fire	16 (5)	16 (5)	16 (5)	20 (6)	13 (4)	16 (5)	-
Office Paper	1ft ² (0.1m ²) pan fire	66 (20)	16 (5)	16 (5)	20 (6)	20 (6)	66 (20)	50 (15)
Silane	-	-	-	-	-	-	-	50 (15)

1.7 RECOMMENDED TYPES OF DETECTORS

Fire Source	UV ^(a)	IR ^(b)	UV/IR ^(c)	IR3 ^(d)	Multi IR ^(e)	UV/IR/Vis
Gasoline	1	1	1	1	1	1
Diesel Fuel	2	2	2	2	2	2
N-Heptane	1	1	1	1	1	1
Kerosene	2	2	2	2	2	1
JP8/JP4/JP5	2	2	2	2	2	4
Alcohol (Ethanol)	2	2	2	2	2	3
Methane	2	3	3	3	3	4
LPG	2	3	3	3	3	4
Hydrogen	2	4	3	4	2	2
Petrochemicals	1	1	2	1	1	1
Metals	2	4	3	4	4	4
Propellants (Black Powder)	1	3	2	3	3	3
Textiles (Cotton)	3	3	3	3	3	4
Aromatic Solvents	2	2	2	2	2	4
Wood, Paper	3	3	3	3	3	4
Bonding Glue Substances	2	2	2	2	1	4

(a) 3600-U-UB

(b) 3600-R

(c) 3600-L-LB, 3600-L4-L4B

(d) 3600-I

(e) 3600-M

1 100% - 75% of detector sensitivity

2 75% - 50% of detector sensitivity

3 50% - 25% of detector sensitivity

4 Not suitable

1.8 LOCATION OF FLAME DETECTOR

- A flame detector is an optical device and thus it needs to have a clear view of the area to properly detect a fire.
- Flame detectors have a 3-D cone of vision ranging from 90 degrees for the 3600 series to 120 degrees for the 3100, 3200 and 3300 Series Flame Detector.
- Sensitivity diminishes at the edges of the cone of vision so there might be some blind spots at the edges. The detector would still respond but the fire would need to be larger, perhaps up to four times that needed at the center of the cone.
- Since both sensitivity and range are related to fire size, if the detector is placed further away from (or closer to) the fire source, the detectable fire size will vary according to the inverse square law. So doubling the detection distance results in only ¼ of the radiant energy reaching the detector, or conversely, for the same response time, the surface area of the fire then needs to be 4 times larger.

