

## Detection and Release Devices

F-12-0-001  
June 2020

### FEATURES

- Repeatable - self-restoring, nothing to replace, testable
- Versatile - various temperature settings available
- Durable - long lasting stainless steel shell
- Economical - wide spacings reduce installation costs
- Factory set
- Internal contact area hermetically sealed in stainless steel shell
- ROHS Compliant

### APPLICATIONS

- Protection of schools, factories, offices, libraries, or other non-residential buildings
- Power generation
- Gas station islands
- Paint spray booths
- Range hoods
- Engine compartments



### DESCRIPTION

DETECT-A-FIRE® (D-A-F) detectors are the "heart" of many fire protection systems. The highly reliable D-A-F has been the standard for over 75 years. The D-A-F is used for signaling overheat or fire conditions. In the vast majority of applications, the D-A-F provides the initial heat sensing that is used to activate suppression systems using clean agent, CO<sub>2</sub>, inert gases, wet or dry chemicals or water.

D-A-F detectors are widely accepted, because they are designed with rate compensation. This provides a unique advantage over both fixed temperature and rate-of-rise types of detectors because the D-A-F detector accurately senses the surrounding air temperature regardless of the fire growth rate. At the pre-determined set point, the system is activated.

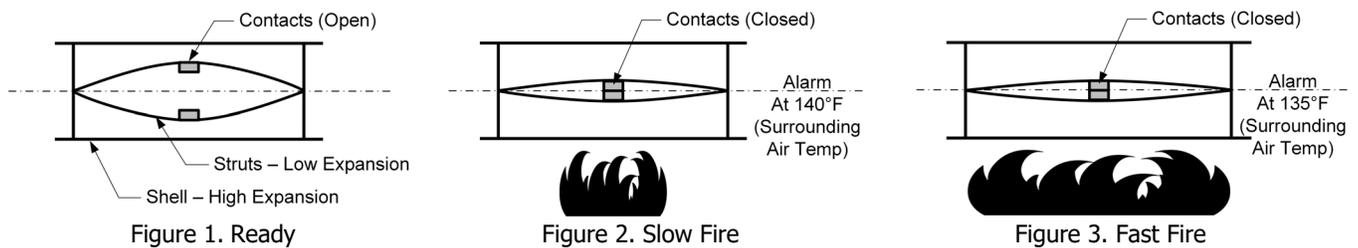
Fixed temperature detectors must be completely heated to alarm temperature and therefore a lag in response time may occur with a fast rate fire. Rate-of-rise devices, on the other hand, are triggered by the rate of increase in ambient temperature and are subject to false alarms caused by harmless, transient thermal gradients such as the rush of warm air from process ovens.

The key to the detector's sensitivity is in the design (Figure 1). The outer shell is made of a rapidly expanding alloy which closely follows changes in surrounding air temperature. The inner struts are made of a slower expanding alloy. Designed to resist thermal energy absorption and sealed inside the shell, the struts follow temperature changes more slowly.

A slow rate fire (Figure 2) will heat the shell and struts together. At the "set point", the detector will trigger, actuating the alarm or releasing the extinguishant.

A transient rush of warm air up to 40°F/min. may expand the shell, while not triggering the detector. By ignoring transient warm air excursions, the D-A-F detector virtually eliminates false alarms prevalent with rate-of-rise devices.

If a fast rate fire (Figure 3) starts, the shell will expand rapidly. The struts will close, actuating the alarm and/or releasing the agent. The faster the fire rate of growth, the sooner the D-A-F detector will react.



## VERTICAL DETECT-A-FIRE DETECTOR SPECIFICATIONS

Vertical D-A-F detectors are designed for use in both "ordinary" or "hazardous" locations. For "ordinary" use, they may be mounted to any approved junction box with 7/8" diameter opening by using 1/2-14 NPT mounting nuts. The device may be wired in or out of conduit, depending on local preferences and codes. To facilitate supervision of system wiring, four lead wires are provided on normally open vertical detectors (that close on temperature rise). When mounted in a appropriately classified mounting box (i.e. Figure 7), detectors are Underwriters Laboratory and Underwriters Laboratory of Canada listed, and FM Approved for hazardous locations.

### VERTICAL MODELS

**Table 1: Model Numbers 27121, 28021, 27120\*, 28020\***

°F Setting	°F Tolerance	°C Setting	°C Tolerance	Spacing (in feet)			RTI	Color Coding
				UL	ULC	FM		
140	+7/-8	60	+4/-5	50	50	20	V-Fast	Black
160	+7/-8	71	+4/-5	25	25	20	V-Fast	Black
190	+7/-8	88	+4/-5	50	50	25	V-Fast	White
210	+7/-8	99	+4/-5	25	50	25	V-Fast	White
225	+7/-8	107	+4/-5	25	50	25	V-Fast	White
275	±10	135	±6	25	50	25	V-Fast	Blue
325	±10	163	±6	50	50	25	V-Fast	Red
360	±10	182	±8	25	50	30	V-Fast	Red
450	±15	232	±10	25	50	30	V-Fast	Green
500**	±15	260	±10	50	50	30	V-Fast	Orange
600**	±20	316	±12	N/A	50	30	V-Fast	Orange
725**	±20	385	±12	N/A	50	30	V-Fast	Orange

**Notes:**

- For clean agents or CO2 suppression systems, ceiling spacing is 20ft. apart unless otherwise specified.
- For NFPA Guidelines on ceiling height compensation, see Table 7.
- \*27120 and 28020 are normally closed devices and do not meet the requirements of NFPA-72 for use as initiating devices (they are 2-wire devices).
- \*27120 and 28020 are not listed by FM with RTI.
- \*\* Not available for Normally Closed detectors

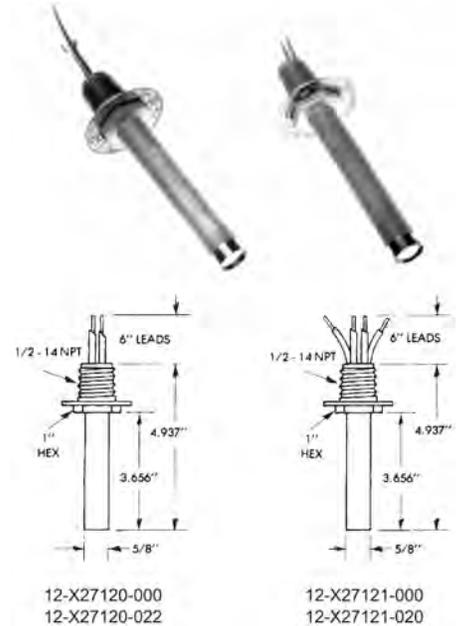


Figure 4. Hexagonal Head

**Table 2: Vertical D-A-F Specification**

Model Number	Head Material	Contact Operation	Electrical Rating (Resistive Only)
27120-0	Brass	Normally Closed (Open on Rise)	5.0 Amps 125 VAC 0.5 Amps 125 VDC
27120-22	Stainless Steel		
27121-0	Brass	Normally Open (Close on Rise)	5.0 Amps 125 VAC 0.5 Amps 125 VDC 2.0 Amps 24 VDC 1.0 Amps 48 VDC
27121-20	Stainless Steel		
28020-3	Stainless Steel	Normally Closed (Open on Rise)	5.0 Amps 125 VAC 0.5 Amps 125 VDC
28021-5	Stainless Steel	Normally Open (Close on Rise)	5.0 Amps 125 VAC 0.5 Amps 125 VDC 2.0 Amps 24 VDC 1.0 Amps 48 VDC
12-200001-00X*			

Approximate weight: 5 oz. All shell material is Stainless Steel. All Stainless Steel is Type 300.

\* Specialty product with limited availability.

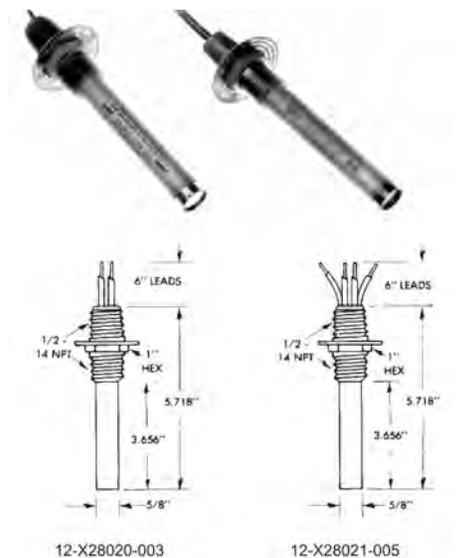


Figure 5. Coupling Head

## HORIZONTAL DETECT-A-FIRE DETECTOR SPECIFICATIONS

Horizontal D-A-F detectors are designed for locations where appearance is a factor. The low-profile, functional design lends physical protection of the detector while making it suitable for commercial, industrial, mercantile public buildings, institutions, and marine applications in non-hazardous locations (those classified as "ordinary" under the National Electric Code). Flush mounted detectors are designed to fit standard 4-inch octagonal electric boxes and surface mounting detectors are designed to mount directly on ceilings or on 4-inch electrical junction boxes. Canadian Electrical Codes requires mounting only to an electrical junction box.

### Horizontal Models

**Table 3: Model Numbers: 27021-0, 27021-1, 27020-0\*, 27020-1\***

°F Setting	°F Tolerance	Spacing (in feet)			RTI	Color Coding
		UL	ULC	FM		
140	+7/-8	50	50	20	Quick	Black
160	+7/-8	25	25	20	Quick	Black
190	+7/-8	50	50	25	Fast	White
210	+7/-8	25	50	25	Fast	White
225	+7/-8	25	50	25	Fast	White
275	±10	25	50	25	Fast	Blue
325	±10	50	50	25	Fast	Red

- \*27020-0 and 27020-1 are normally closed devices and do not meet the requirements of NFPA-72 for use as initiating devices (they are 2-wire devices).
- \*27020-0 and 27020-1 are not listed by FM with RTI.

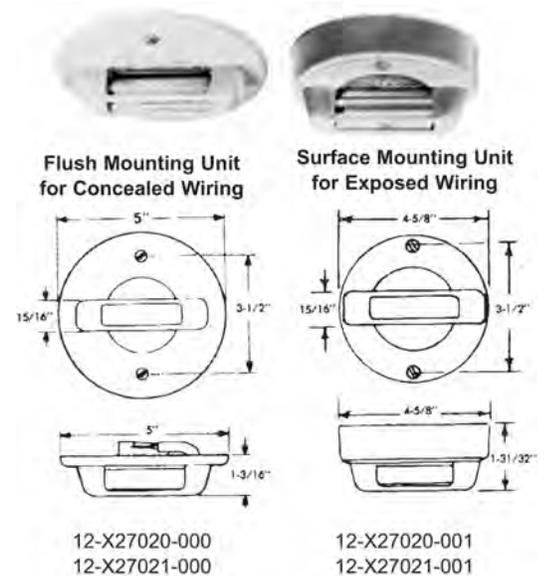


Figure 6. Horizontal Detectors

**Note:** Horizontal D-A-F detectors are equipped with connector blocks in place of leadwires.

**Table 4: Horizontal D-A-F Specifications**

Model Number	Mounting Style	Contact Operation	Electrical Rating (Resistive Only)
27020-0	Flush Mount	Normally Closed (Open on Rise)	5.0 Amps 125 VAC 0.5 Amps 125 VDC
27020-1	Surface Mount		
27021-0	Flush Mount	Normally Open (Close on Rise)	5.0 Amps 125 VAC 0.5 Amps 125 VDC 2.0 Amps 24 VDC 1.0 Amps 48 VDC
27021-1	Surface Mount		

Approximate weight: 10 oz.

## HORIZONTAL AND VERTICAL DETECT-A-FIRE

**Table 5: D-A-F Response Time Index (RTI) and Spacing**

Model No.	Configuration	Contact Operation	Temperature (Set Point)	Response Time Index (ft-s) <sup>1/2</sup>	RTI Classification	RTI Rated Spacing	Old Rated Spacing
27021-0	Horizontal Flush Mount	Normally Open (Close on Rise)	140°F (60°C), 160°F (71°C)	110	Quick	(20 X 20) ft (6 x 6) m	(25 x 25) ft (8 x 8) m
27021-1	Horizontal Surface Mount						
27021-0	Horizontal Flush Mount	Normally Open (Close on Rise)	190°F (88°C), 210°F (99°C), 225°F (107°C), 275°F (135°C), 325°F (163°C)	140	Fast	(25 x 25) ft (8 x 8) m	(25 x 25) ft (8 x 8) m
27021-1	Horizontal Surface Mount						
27121-0	Vertical Brass Head	Normally Open (Close on Rise)	140°F (60°C), 160°F (71°C), 190°F (88°C), 210°F (99°C), 225°F (107°C), 275°F (135°C), 325°F (163°C), 360°F (182°C), 450°F (232°C), 500°F (260°C), 600°F (316°C), 725°F (385°C)	99 (140°F, 160°F) 148 (190°F, 210°F), 225°F, 275°F, 325°F, 360°F, 450°F, 500°F, 600°F, 725°F)	V-Fast	(30 X 30) ft (9 x 9) m	(25 x 25) ft (8 x 8) m
27121-20	Vertical Stainless Head						
28021-5	Vertical Stainless Coupling Head						

**Note:** Spaces shown are distances between detectors on smooth ceilings, the distances from partitions or walls would be half that shown. Authority Having Jurisdiction (AHJ) should be consulted before installation.

## DETECT-A-FIRE MOUNTING

D-A-F detectors are not position sensitive. Horizontal and vertical detectors refer to the most common mounting configuration for that detector. However each type can be mounted either horizontally or vertically depending on the application and installation requirements.

**Table 6: Mounting and Hazardous Location Class**

Model Number (Vertical Only)	Hazardous Location	Fitting required for UL & ULC Listing and FM Approval
27120-2 27121-20 28020-3 28021-5	Class I, Groups A, B, C and D; Class II, Groups E, F and G	Mount detector to a suitable listed fitting in accordance with National Electric Code and/or local authority having jurisdiction.
27120-0 27121-0	Class I, Groups B, C and D; Class II Groups E, F and G	

**Table 7: Derating Factor for Ceiling Height**

Heat Detector Spacing Reduction Based on Ceiling Height				
Ceiling Height Above		Up to and Including		Derating Factor
m	ft	m	ft	
0	0	3.05	10	1.00
3.05	10	3.66	12	0.91
3.66	12	4.27	14	0.84
4.27	14	4.88	16	0.77
4.88	16	5.49	18	0.71
5.49	18	6.10	20	0.64
6.10	20	6.71	22	0.58
6.71	22	7.32	24	0.52
7.32	24	7.93	26	0.46
7.93	26	8.54	28	0.40
8.54	28	9.14	30	0.34

This table outlines the derating factor required depending on ceiling height based on NFPA 72 guidelines for D-A-F detector installation.

## CONSTRUCTION

- Stainless steel shell sensing element. Cold rolled steel mounting facility. Off-White finish.
- #18 AWG Teflon™ insulated wire is used on detectors exposed to temperatures up to 375°F.
- #16 AWG TGGT insulated wire is used on detectors exposed to temperatures above 375°F.

## MODIFICATIONS

- Add ULC Label to any temperature setting.
- Add fluorocarbon coating for better corrosion resistance on select models and temperatures. (Models 27120-22, 27121-20, 28020- 3, 28021-5. Maximum temperature is 500°F.)
- Add extended leadwires on select models and temperatures.

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## TEMPERATURE SETTING SELECTION

To avoid nuisance activations, Fenwal Controls strongly suggests selecting a D-A-F detector with a temperature setting a minimum of 100°F above the maximum ambient expected temperature.

## DEVICE SELECTION

The table below shows three categories of fire detection devices and their relative response levels for reaction to three different rate-of-rise conditions. Consult the AHJ for specific applications.

**Table 8: Device Selection for Rate-of-Rise Conditions**

Device Type	Under 10°/Min	Between 10-40°/Min	Over 40°/Min
D-A-F Rate Compensated Detector	First	First	Second but at selected protection level
Fixed Temp. Detector	Second	Second	Third
Rate-of-Rise Detector	Third	Third	First but may be a false alarm

## AGENCY LISTINGS

D-A-F detectors are UL and ULC listed and FM Approved as fire detection thermostats (close on temperature rise) and as releasing devices (open on temperature rise).

**Table 9: Agency Approvals**

Agency	File Number	Location
UL	S492	Ordinary
UL	E19310	Hazardous
ULC	CS341-E	Ordinary and Hazardous
FM	J.I. OV2HO.AE	Hazardous
FM	17302	Ordinary
UL	S2410	Ordinary (600 & 725°F)
UL	E89599	Hazardous (600 & 725°F)
CE	IEC 60947-5-1	—

## NOTES:

- D-A-F detectors are temperature preset at the factory.
- For corrosive environments, care should be taken to protect the D-A-F detector to obtain optimal performance and maximum life. Consult factory for fluorocarbon coating option.
- For field wiring requirements to connect to D-A-F, please refer to the installation instructions.
- Per UL521 requirements - low temperature exposure test is - 22°F (-30°C)
- D-A-F detectors are designed for long life expectancy, however due to various field conditions it is required that the detectors be tested annually per NFPA guidelines or local fire codes.
- Replace D-A-F detector after any fire or heat related event, any mechanical damage, or after 10 years of continuous service.
- D-A-F detectors are CE Listed. The product family has been evaluated in accordance with IEC 60947-1 and IEC 60947-5- 1, and is documented under Intertek Report No. 102294754 BOX-001 as an overheat detector. Detectors have a rated insulation and impulse voltages of 1500 VAC.

## DETECT-A-FIRE MOUNTING BOX

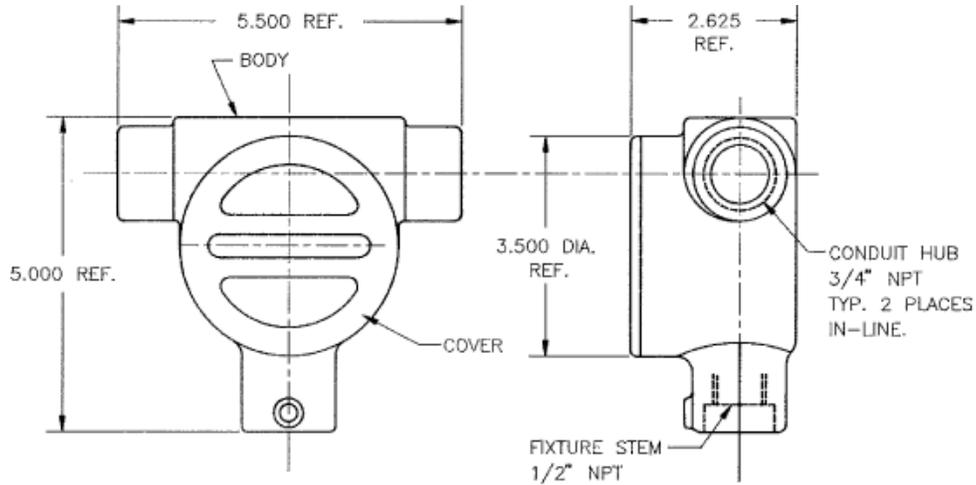


Figure 7. Optional Explosion Proof Mounting Box,  
P/N 06-116317-001

**Note:** Figure 7. Complies with NEC Class I, Groups A, B, C, D, Class II, Group E,F,G, Class III, and U.L. Standard 1203. Explosion Proof Mounting Box must be purchased separately from the D-A-F.

## HOW TO ORDER

1. Select a D-A-F model from specifications in Table 2 for vertical design or Table 4 for horizontal design.
2. Select a temperature rating from Table 1 for vertical design or Table 3 for horizontal design.

**Note:** To avoid nuisance activations, Fenwal Controls strongly suggests selecting a D-A-F detector with a temperature setting a minimum of 100°F above the maximum ambient expected temperature.

3. Optional, select item from the Modifications Section. Consult Fenwal Controls to ensure modifications are available on the selected model.

Example: **27121-20** at **190°F** with **Fluorocarbon Coating**

Table 10: Stocked Models and Temperature Settings

Model	Style	Contact Type	Temperature Setting (°F)												
			140	160	190	210	225	275	325	360	450	500	600	725	
27020-0	Horizontal, Flush Mount	NC	S		S						N/A	N/A	N/A	N/A	N/A
27020-1	Horizontal, Surface Mount	NC	S								N/A	N/A	N/A	N/A	N/A
27021-0	Horizontal, Flush Mount	NO	S		S			S			N/A	N/A	N/A	N/A	N/A
27021-1	Horizontal, Surface Mount	NO	S		S						N/A	N/A	N/A	N/A	N/A
27120-0	Vertical, Brass Head	NC	S	S	S			S		S				N/A	N/A
27120-22	Vertical, Stainless Steel	NC	S		S			S						N/A	N/A
27121-0	Vertical, Brass Head	NO	S	S	S	S	S	S	S	S	S	S	S	S	S
27121-20	Vertical, Stainless Steel	NO	S	S	S			S	S	S		S		S	
28021-5	Vertical, Coupling Head	NO			S			S		S	S	S			

**S** - Stocked D-A-F detector available for quick delivery of a limited quantity. Other models and variations are manufactured on demand.

### EXPORT INFORMATION (USA)

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