Coffee Break Training - Fire Protection Series

Fire Alarms & Detection: Fire Signatures for Fire Detection

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Learning Objective: *The student shall be able to describe how fire signatures influence detector selection.*

The thermal and visible outputs from this flame are two examples of fire "signatures."

Fire detection devices operate in a variety of ways. To simply say that a smoke detector activates when it senses smoke is an oversimplification of the operating principles for which it is designed.

Fire detection devices (smoke detectors, heat detectors, radiant energy detectors, gas detectors) are designed to detect changes in the atmosphere produced by changes resulting from a fire. These changes are known as "fire signatures" and can be measured by various detection devices.

Fire Effect	Specific "Fire Signature"	Preferred Detector Type
Heat (Thermal)	*Response to heat energy, transported by air movement or conduction.*	
	High temperature	Fixed temperature (spot)
	Rapid temperature rise	Rate-of-rise (spot)
	High temperature	Rate compensated
	High temperature	Continuous line (ceramic core)
	High temperature	Continuous line (electrical)
	Pressure increase due to thermal expansion of gases/High temperature	• Rate-of-rise (spot) • H.A.D. (pneumatic Heat Actuated Device) (Obsolete)
	Pressure increase due to thermal expansion of gases/High temperature	• Rate-of-rise (spot) • Continuous line (pneumatic tube) (Obsolete)
Smoke (Aerosol)	*Response to particulate products of combustion, transported by air movement.*	
	Visible products of combustion	Photoelectric (spot or beam)
	Microscopic products of combustion	Ionization (spot)
	Submicroscopic particles due to overheating conditions	• Cloud chamber • Air sampling • Video algorithm
Flame (Radiant)	*Response to electromagnetic energy, transported by radiation. Not affected by air flow.*	
	Electromagnetic radiation pulsing at 4 to 30 Hz (usually infrared or visible)	Flicker (open area)
	Electromagnetic radiation, especially in the range of 0.17 to 0.29 micron wavelengths in the ultraviolet region	Ultraviolet (open area)
	Electromagnetic radiation, especially in the range of 3.8 to 4.45 micron wavelengths	Infrared (open area)
Pressure	*Response to sudden pressure increase—shock wave. Commonly used in automatic explosion suppression systems.*	
	Pressure increase due to thermal expansion of gases	Continuous line (pneumatic tube) (Obsolete)
Fire gas (Gas)	*Respond to nonsmoke gases, transported by air movement (combustible gases, carbon dioxide, carbon monoxide, hydrogen sulfide). Detection devices are calibrated to discrete gases within specific acceptable ranges.*	
Production gases (Gas)	*Respond to nonsmoke gases, transported by air movement (butane, propane, carbon monoxide, hydrogen). Detection devices are calibrated to discrete gases within specific acceptable ranges.*	

For additional information, refer to National Fire Protection Association 72, *National Fire Alarm Code*.