Max Fire Training Inc.

Max Fire Box Users Guide

Max Fire
Training Inc.

Mission Statement

Providing a cost effective fire and smoke behavior training aid that allows current and future firefighters the ability to recognize rapid fire events in a controlled environment.

Max Fire
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If you have any questions please email, call or text me.

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This users guide is designed to assist you with your first burn.

Your portable drive includes video of the proper way to load the fuel loads and video of a burn

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As the pieces of particle board are heated to their ignition temperature you will be able to show the elements of the fire tetrahedron come together.

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At this phase of the burn, review the following fire behavior terms.

Ignition

Beginning of flame propagation or burning; the start of a fire.

Fire Point

Temperature at which a liquid fuel produces sufficient vapors to support combustion once the fuel is ignited. The fire point is usually a few degrees above the flash point.

Fire

Rapid oxidation of combustible materials accompanied by the release of energy in the form of heat and light

Combustion

An exothermic chemical reaction that is a self-sustaining process of rapid oxidation of a fuel that produces heat and light.

Heat Energy

Once the fire is ignited, the combustion process produces more heat. The OSB (wood) in the form of a solid heat energy is required to raise its temperature in order to begin to liberate fuel molecules to a gaseous state before the OSB (wood) can burn.

Heat Energy

Once the combustion is initiated, the extra heat energy that is produced will increase the temperature and accelerate the burning process.

Surface-To-Mass Ratio

The ratio of the surface area of the fuel to the mass of the fuel.

Fire Triangle

Plane geometric figure of an equilateral triangle that is used to explain the conditions necessary for fire.

Fire Triangle

The sides of the triangle represent heat, oxygen, and fuel. The fire triangle was used prior to the general adaptation of the fire tetrahedron that includes a chemical chain reaction.

Fire Tetrahedron

Model of the four elements/conditions required to have a fire.

Fire Tetrahedron

The four sides of the tetrahedron represent fuel, heat, oxygen, and chemical chain reaction.

Incipient Stage

First stage of burning process in a confined space in which the substance being oxidized is producing some heat, but the heat has not spread to other substances nearby.

Incipient Stage

During this phase, the oxygen content of the air has not been significantly reduced.

Flame

Visible, luminous body of a burning gas emitting radiant energy including light of various colors given off by burning gases or vapors during the combustion process.

Heat

A form of energy characterized by vibration of molecules and capable of initiating and supporting chemical changes and changes of state.

Stratification

Formation of smoke into layers as a result of differences in density with respect to height with low density layers on the top and higher density layers on the bottom.

Radiation

The transmission or transfer of heat energy from one body to another body at a lower temperature through intervening space by electromagnetic waves such as infrared thermal waves, radio waves, or X-rays.

Convection

Transfer of heat by the movement of heated fluids or gases, usually in an upward direction.

Pyrolysis

Thermal or chemical decomposition of fuel (matter) because of heat that generally results in the lowered ignition temperature of the material.

Pyrolysis

The pre-ignition combustion phase of burning during which heat energy is absorbed by the fuel, which in turn gives off flammable tars, pitches, and gases.

Pyrolysis of wood releases combustible gases and leaves a charred surface.

Exothermic Reaction

Chemical reaction that releases thermal energy or heat.

Endothermic Reaction

Chemical reaction that absorbs thermal energy or heat.

Products of Combustion

Materials produced and released during burning.

Flow Path

Composed of at least one inlet opening, one exhaust opening, and the connecting volume between the openings.

Flow Path

The direction of the flow is determined by difference in pressure. Heat and smoke in a high-pressure area will flow toward areas of lower pressure (NIST)

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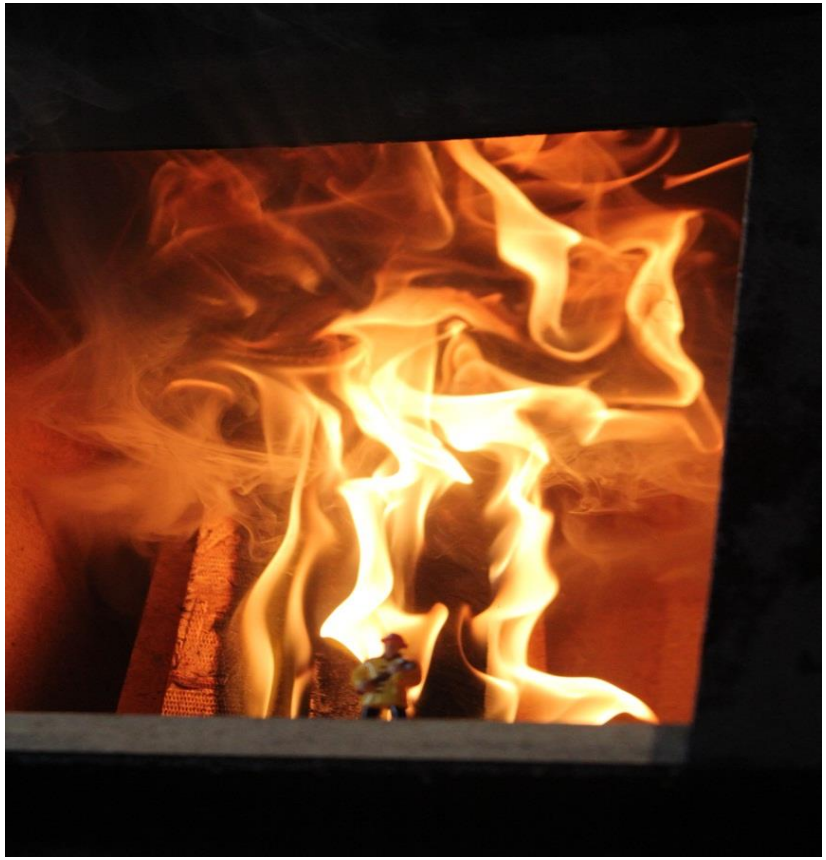
As the fire begins to grow, the smoke will accumulate at the ceiling level. The open door allows air flow to the fire which allows the ceiling surface to be heated considerably by the hot smoke gases.



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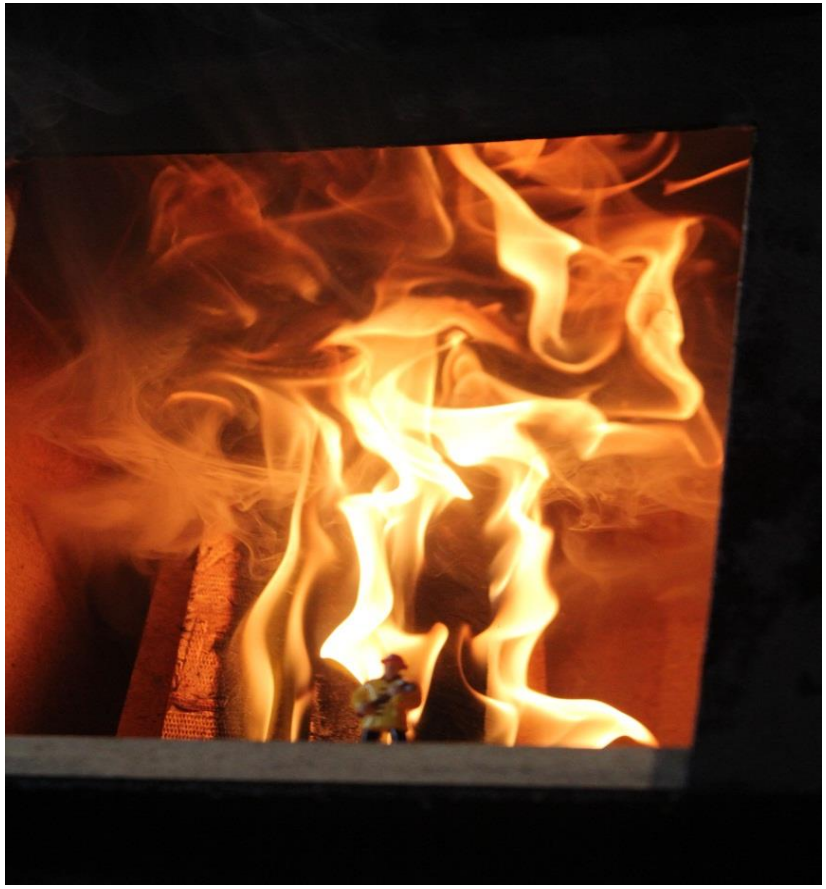
At this time the fire has reached the growth stage. At this phase of the burn, you will be able to review the following fire behavior terms.



Growth Stage

The early stage of a fire during which fuel and oxygen are virtually unlimited. This phase is characterized by a rapidly increasing release of heat.

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The growth phase of the burn is an extremely important phase.

Firefighters will witness smoke and fire behavior that indicates rapid fire events getting ready to take place.

Ceiling Jet

A relatively thin layer of flowing hot gases that develops under a horizontal surface (e.g., ceiling) as a result of plume impingement and the flowing gas being forced to move horizontally.

Thermal Layering

Outcome of combustion in a confined space in which gases tend to form into layers, according to temperature, with the hottest gases found at the ceiling and the coolest gases at the floor level.

Neutral Plane

The level at a compartment opening where the difference in pressure exerted by expansion and buoyancy of hot smoke flowing out of the opening and the inward pressure of cooler, ambient temperature air flowing in through the opening is equal.

Smoke Indicators

Rapidly increasing volume, turbulence, darkening color, optical density, and lowering of the hot gas level.

Air Flow Indicators

High velocity and turbulence, bi-directional movement with smoke exiting at top of doorway and fresh air moving in at the bottom, or pulsing air movement.

Heat Indicators

Rapidly increasing temperature in the compartment, pyrolysis of contents of fuel packages located away from the fire, darkened windows, or hot surfaces.

Flame Indicators

Isolated flames in the hot gas layers or near the ceiling

Rollover

A condition where the unburned fire gases that have accumulated at the top of a compartment ignite and flames propagate through the hot-gas layer or across the ceiling.

Plume

The column of hot gases, flames, and smoke rising above a fire; also called convection column, thermal updraft, or thermal column.

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Allowing firefighters to recognize smoke and fire behavior indicators that represent rapid fire events assists firefighters with determining fire suppression tactics.

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During this phase of the burn apply a small amount of water to the upper atmosphere of the Max Fire Box to show how you can reset the fire and cool the fire gases overhead allowing firefighters time to escape the rapid fire event getting ready to take place.

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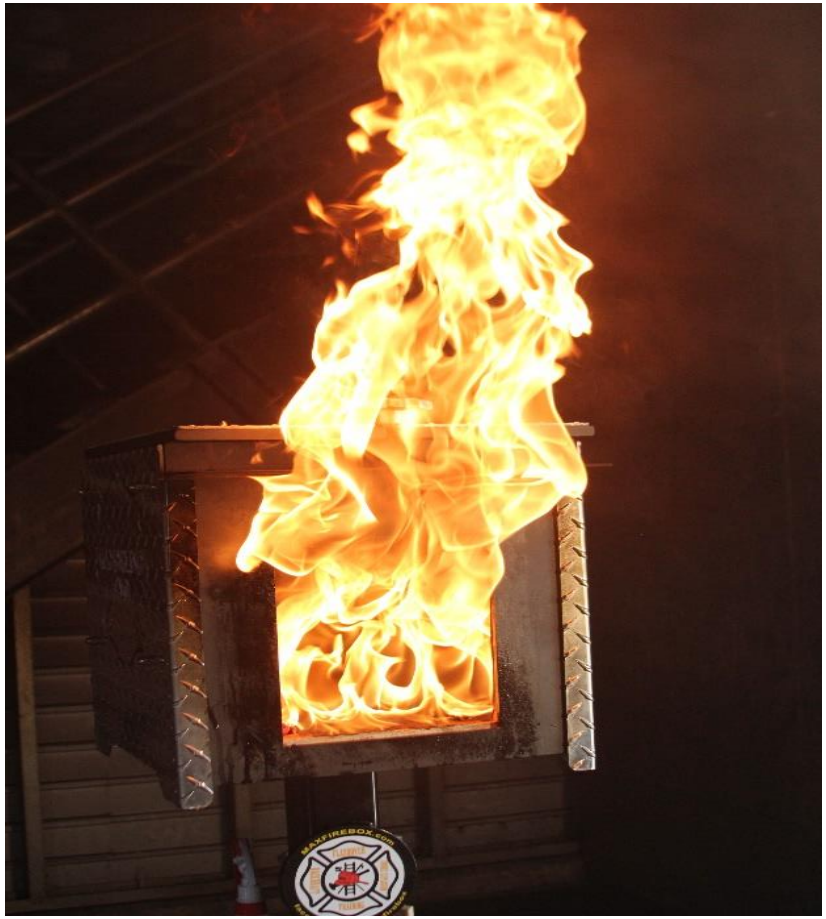
Upon completion of cooling the fire gases, the fire is transitioning to flashover. At this phase of the burn, you will be able to review the following fire behavior terms.

Flashover

The sudden full-room involvement in flame. Flashover is caused by thermal radiation feedback. During a fire in a room, the heat is absorbed into the ceiling and walls and radiated downward, gradually heating the combustible gases and contents to their ignition temperature, and the room and its contents simultaneously ignite.



Rapidity

Although it is not an instantaneous event, flashover happens rapidly, often in a matter of seconds, to spread complete fire involvement within the compartment.

Ignition Of All Exposed Surfaces

Virtually all combustible surfaces in the enclosed space become ignited.

Transition In Fire Development

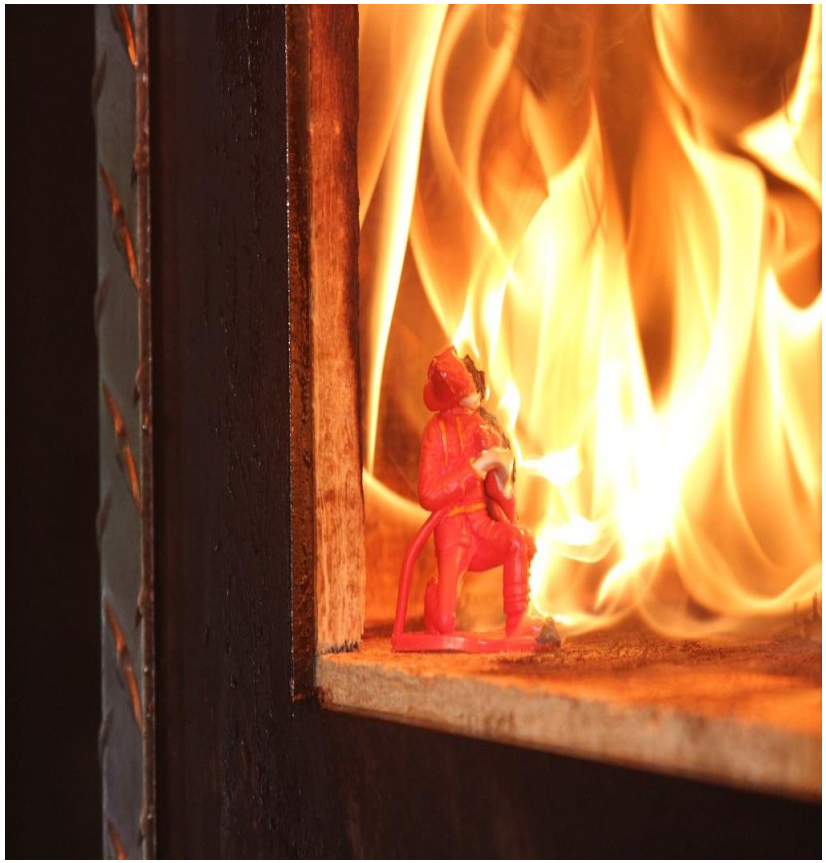
Flashover represents a transition from the growth stage to the fully developed stage.

Flashover

Survival rates for firefighters that are in flashovers are extremely low. Allowing firefighters to witness this hostile fire event in a controlled environment reduces firefighter injuries and death.

Flashover

- Stress that the firefighters would be at floor level during this stage of the burn!



Flashover

At this stage of the burn the fire has reached the fully developed stage. During this phase of the burn, you are able to review the following fire behavior terms.

Fully Developed Stage

Stage of burning process where energy release is at maximum rate and is limited only by availability of fuel and oxygen.

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During the fully developed stage, the door is used to limit the oxygen supply to the fire.

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When removing the door firefighters are able to witness the fire experiencing oxygen deficiency. During this phase of the burn you are able to show the rapid change in smoke conditions.

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As air is allowed to enter the Max Fire Box firefighters are able to see the four key factors (volume, velocity, density, color) of changing smoke behavior take place.

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At this phase of the burn, you are able to review the following fire behavior and smoke terms.

Volume

Amount of fuel off-gassing or the fullness of the “Box”

Velocity

How fast the smoke is leaving. Indicates pressure build up. Only volume and heat can cause pressure.

Density

Quality of burning. Potential for event/Perhaps the most important factor. The thicker the smoke the more dangerous it is.

Color

Degree of black/gray=which stage of heating and distance from the fire.

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The importance of door control/flow path control should be reviewed.

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During this phase of the burn, as the smoke is exiting the Max Fire Box you are able to show how the smoke is fuel and is extremely flammable.

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Using a propane torch ignite the smoke. This demonstrates to firefighters that while they are inside a structure fire the atmosphere above them is extremely flammable.

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The importance of cooling water and door control is stressed during this portion of the burn.

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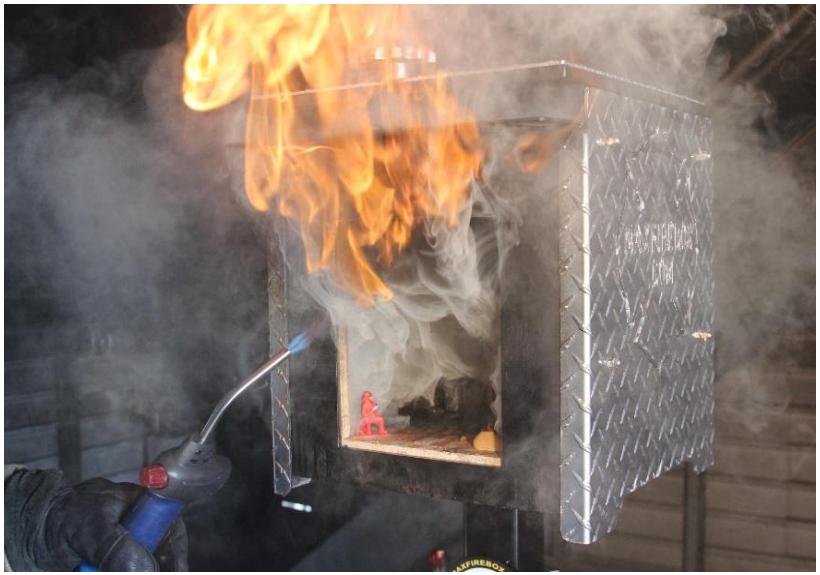
At this phase of the burn, you are able to review the following fire behavior and smoke terms.

Ignition Temperature

The lowest temperature a fuel will off-gas an ignitable mixture that can self-ignite.

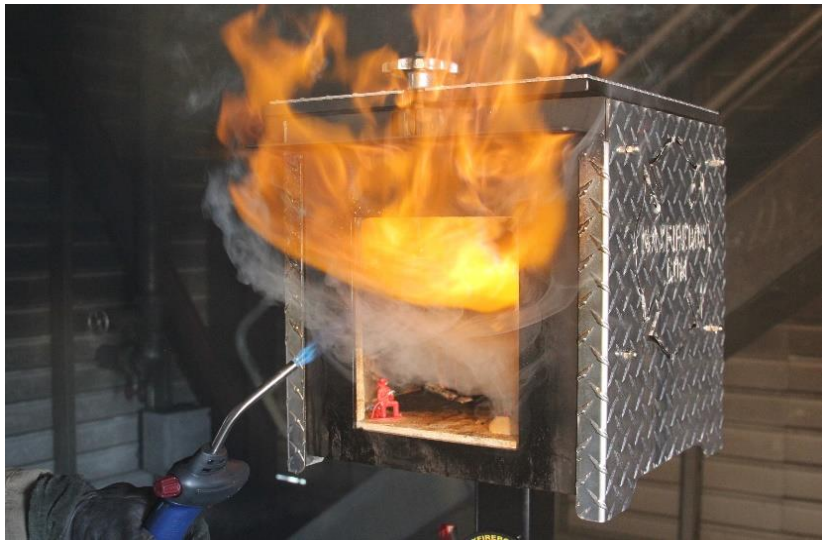
Fire Point

The lowest temperature a fuel will off-gas an ignitable mixture that will ignite and continue to burn given an ignition source.



Flammable Range

The range between the upper flammable limit and lower flammable limit in which a substance can be ignited.



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The next phase of burn will be allowing the fire to grow. Additional pieces of particle board will be added to the Max Fire Box. The additional material will allow the fire to be heated to a higher temperature.

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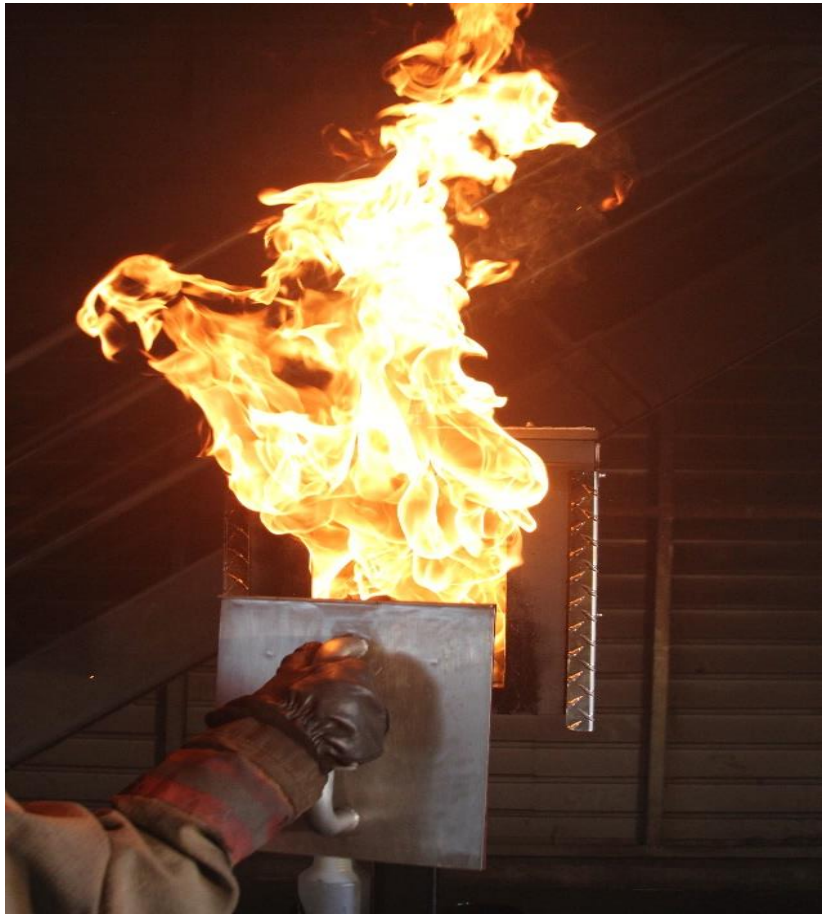
If unable to produce the backdraft during your burn allow the fire additional burn time. Keep in mind the temperature of the smoke plays a critical role in the backdraft



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When the fire is heated to a higher temperature, the door will be used to limit the oxygen flow to the fire. When the door is removed firefighters will be able to witness a backdraft in a controlled environment.

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When the door is removed firefighters will be able to witness a backdraft in a controlled environment.

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This presents an additional opportunity for firefighters to witness a rapid fire event. At this phase of the burn, you will be able to review the following fire behavior and smoke terms.

Backdraft

Instantaneous explosion or rapid burning of superheated gases that occurs when oxygen is introduced into an oxygen-depleted confined space.

Backdraft

The stalled combustion resumes with explosive force. It may occur because of inadequate or improper ventilation procedures.

Backdraft Indicators

Smoke leaving the box in puffs. Dense smoke with a grayish yellow color.

Backdraft Indicators

Little or no visible flame. Inwardly drawn smoke (Sucking Phenomenon). Pressurized smoke exiting small openings.

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After the fire backdrafts, firefighters will be able to witness a smoke explosion. Using the door to limit the oxygen supply to the Max Fire Box will allow it to fill with combustible gases.

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Using a propane torch ignite the smoke. At this phase of the burn, you are able to review the following terms.

Smoke Explosion

Form of fire gas ignition; ignition of accumulated flammable products of combustion and air that are within their flammable range.

Flammable Range

The range between the upper flammable limit and lower flammable limit in which a substance can be ignited.

Decay

Stage of fire development when fuel is consumed and energy release diminishes, and temperatures decrease. During this stage the fire goes from ventilation controlled to fuel controlled.

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The definitions provided are a brief overview of the type of live fire training you can do in a safe and cost effective manner.

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Enjoy getting out of the classroom and using your Max Fire Box

Post some pictures and videos of your training

@MaxFireBox

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