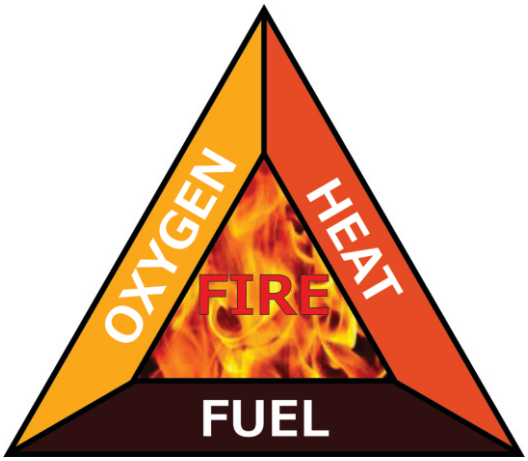
Fire Triangle



The fire or combustion triangle represents the three elements a fire needs to ignite.
When all three elements are present and combined in the right mixture a fire will naturally occur. Fires can be extinguished or prevented by removing any one of the three elements.

Fire Tetrahedron
Represents the addition of a component "the chemical chain reaction" to the three already present in the fire triangle. Once a fire has started, the resulting exothermic chain reaction sustains the fire and allows it to continue until or unless at least one of the elements of the fire is blocked. Combustion is the chemical reaction that feeds a fire more heat and allows it to continue.

Fire Class: In Australia fires are categorised into 6 different classes. It is also possible to have more than one class in the same fire.

Class A Solids	Class B Flammable Liquid	Class C Flammable Gas	Class D Combustible metals	Class E Electrical	Class F Cooking Oils & Fats
Paper	Petrol	Natural Gas	Magnesium	Potentially Energised Electrical Equipment	Vegetable Oils
Timber	Kerosene	LPG	Potassium		Animal Fats
Plastic	Grease	Butane	Titanium		Olive Oil
Textiles	Turps	Hydrogen	Aluminium		Sesame Seed Oil
Leather	Diesel	Methane	Lithium		

Extinction of the fire: to stop combustion reaction, one of the three elements of the fire triangle must be removed.

Heat: without sufficient heat a fire cannot start or continue, heat can be removed by the application of a substance which reduces the amount of heat available to the fire reaction.

Fuel: without fuel a fire will stop.

Oxygen: without sufficient oxygen a fire cannot begin or continue.

Some extinguishing agents will work better than others depending on the class of fire, some may also make the situation worse. Ensure you can identify the class of fire before trying to extinguish it.

First Attack Fire Fighting

Before you start fighting a fire you must first establish your priorities.

1. Life - Ensure you have removed people from danger first. This must be your number one priority

2. You must then raise the alarm, if you have nominated a person to contact the fire brigade ensure you get confirmation that they have done this. Don't worry if you extinguish the fire before their arrival.

3. You will need to assess the following:

- **Support:** Do not fight the fire on your own.
- **Fire Size:** Fight small fires only, if the flames are over one metre square or over your hip in size it is beyond the capabilities of a fire extinguisher.
- **Additional Hazards:** What else is close by i.e. flammable liquid, chemicals, gas cylinders.
- **Fire Class:** Are you able to positively identify the Class of Fire.
- **Fire Extinguishers:** Do you have the right extinguisher available and is it close to you.
- **Environment:** You are not exempt from smoke inhalation, ensure you have an escape plan and always have an exit behind you.

Extinguishers are designed for small fires only; a fire will double in size every thirty seconds so your extinguishment opportunity is only small. Once you have removed the extinguisher from the mounting bracket remember PASS.

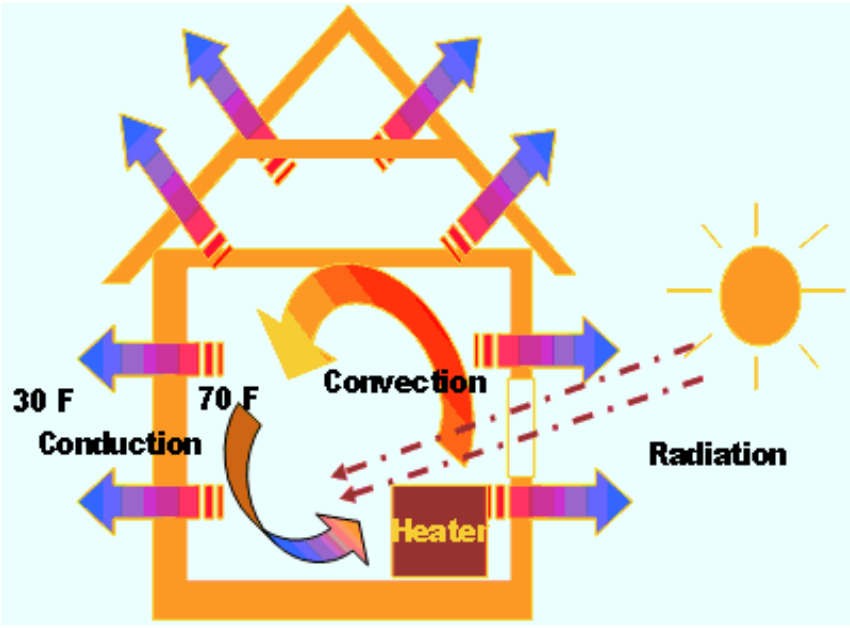
Remember: Never turn your back on a fire, if you have been able to extinguish the fire continue to monitor the area until the fire brigade has arrived, again be cautious of any smoke. If one extinguisher was unable to bring the fire under control you will need to re-assess the situation.

Would another extinguisher bring the situation under control and is there another extinguisher available? While a Fire Hose Reel will give you unlimited amount of water you are very limited to the Fire Class you can use the water on. Rolling out a hose reel will also introduce additional hazards to the area such as "Trip & Slip". You must be able to identify the fire as **Class A Only.**

Fire Spread

Heat can travel throughout a burning building by one or more of three methods, commonly referred to as conduction, convection and radiation.

Conduction: The spread of heat energy through solids, from one body to another by direct contact or by an intervening heat-conducting medium. The amount of heat that will be transferred and its rate of travel depends upon the conductivity of the material through which the heat is passing. Not all materials have the same heat conductivity, most metals are good heat conductors. Aluminium, copper and iron are good conductors. Fibrous materials, such as felt, cloth and paper are poor conductors.



Liquids and gases are poor conductors of heat because of the movement of their molecules. Air is a relatively poor conductor. Certain solid materials when shredded into fibres and packed into batts, make good insulation because the material itself is a poor conductor and there are air pockets within the insulation. Double building walls that contain an air space provide additional insulation.

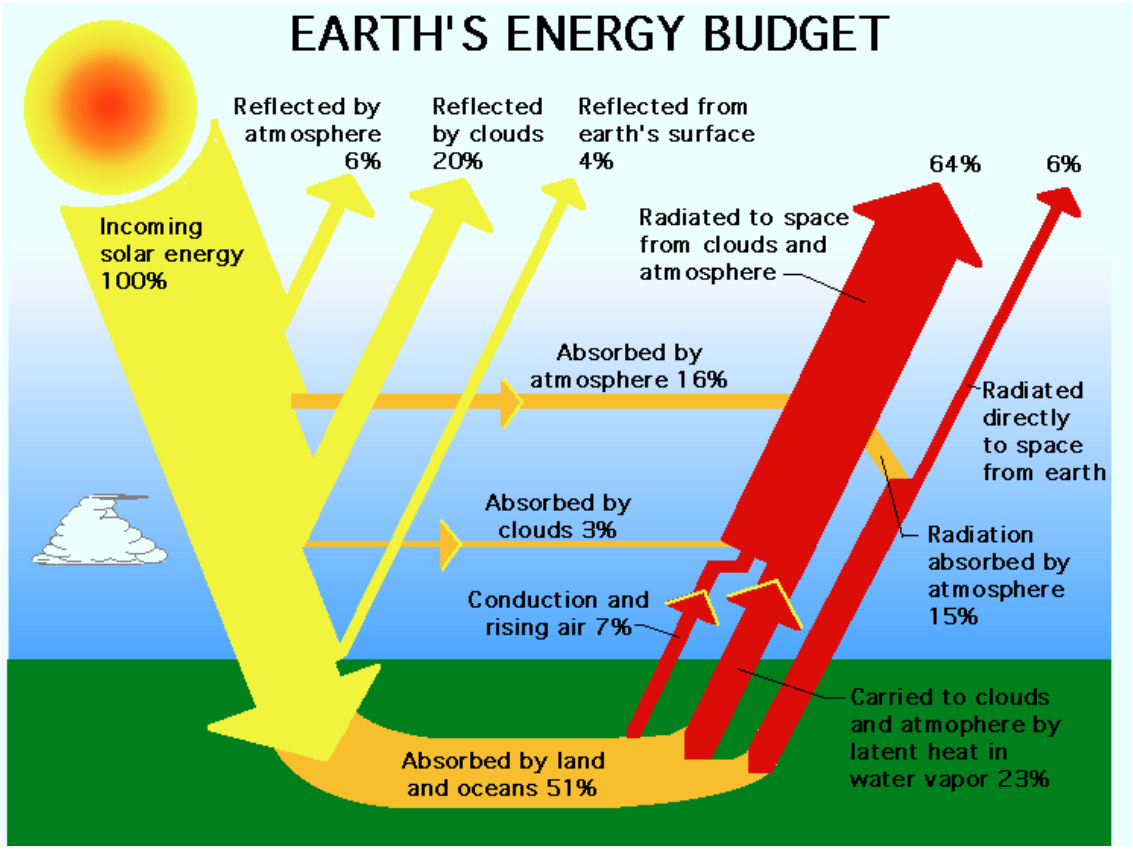
Convection: Is the transfer of heat by the movement of air or liquid. When water is heated in a glass container, the movement within the vessel can be observed through the glass. If some sawdust is added to the water, the movement is more apparent. As the water is heated, it expands and grows lighter, hence, the upward movement. In the same manner, air becomes heated near a steam radiator by conduction. It expands, becomes lighter and moves upward. As the heated air moves upward, cooler air takes its place at the lower levels.

Heated air in a building will expand and rise. For this reason, fire spread by convection is mostly in an upward direction, although air currents can carry heat in any direction. Convected currents are generally the cause of heat movement from floor to floor, from room to room and from area to area. The spread of fire through corridors, up stairwells and elevator shafts, and between walls is mostly caused by the convection of heat currents and has more influence upon the positions for fire attack and ventilation than either radiation or conduction.

Fire Spread

Another form of heat transfer by convection is direct flame contact. When a substance is heated to the point where flammable vapours are given off, these vapours may be ignited, creating a flame. As other flammable materials come in contact with the burning vapours, or flame, they may be heated to a temperature where they too, will ignite and burn.

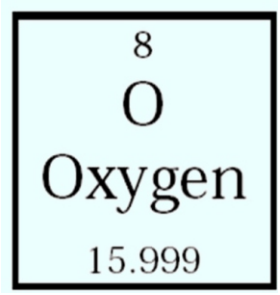
Radiation: Emission of heat energy through electromagnetic radiation in the infra-red part of the spectrum, which is then absorbed by matter to varying degrees: This is why when standing by a fire you only feel the heat on the side that is facing the fire. Heat and light waves are similar in nature, but they differ in length per cycle. Heat waves are longer than light waves and they are sometimes called infrared rays. Radiated heat will travel through space until it reaches an opaque object. As the object is exposed to heat radiation, it will in return radiate heat from its surface. Radiated heat is one of the major sources of fire spread, and its importance demands immediate attention at points where radiation exposure is severe.



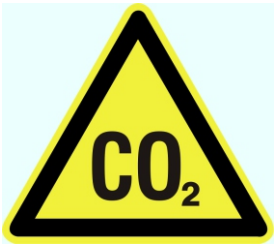
Back Draft

If unable to extinguish a fire, compartmenting a fire can be an effective way of slowing it down. Closing doors and windows to a room that has a fire may help reduce the amount of oxygen a fire has, slowly and in some occasions extinguishing a fire. If investigating the smell of smoke, caution should be exercised when opening closed doors, feel the door with the back of your hand or any door knobs as metal is a good conductor of heat.

Smoke appearing from under or around a doorway would indicate little oxygen left within that room, opening that door will feed the room oxygen and may cause a backdraft. Fire-fighters responding to a confined fire that is late in the free-burning phase or in the smouldering phase risk causing a backdraft or smoke explosion if the science of fire is not considered in opening the structure.



In the smouldering phase of a fire, burning is incomplete because not enough oxygen is available to sustain the fire. However, the heat from the free-burning phase remains, and the unburned carbon particles and other flammable products of combustion are just waiting to burst into rapid, almost instantaneous combustion when more oxygen is supplied. Proper ventilation releases smoke and the hot unburned gases from the upper areas of the room or structure. Improper ventilation at this time supplies the dangerous missing link -- oxygen. As soon as the needed oxygen races in, the stalled combustion resumes, and it can be devastating in its speed, truly qualifying as an explosion.



Combustion is related to oxidation, and oxidation is a chemical reaction in which oxygen combines with other elements. Carbon is a naturally abundant element present in wood, among other things. When wood burns, carbon combines with oxygen to form carbon dioxide, or carbon monoxide, depending on the availability of oxygen. When oxygen is no longer available, free carbon is released in the smoke. A warning sign of possible backdraft is dense, black (carbon-filled) smoke.