Fire – A Boaties Nightmare



Fires don't discriminate with over 140 marine craft fires with total losses in excess of $37M reported to and attended by Department of Fire and Emergency Services (previously FESA) in the last 10 years. In fact, during the 2012-2013 financial year there were 28 fires with losses of approx $2.4M.

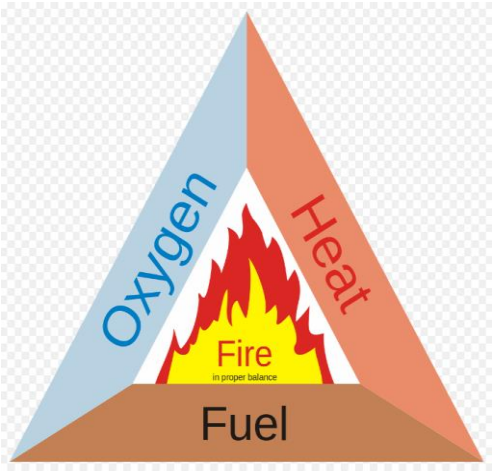
Fires are a real problem on board any vessel due to the confined space and the speed at which fire spreads. Any fire on a boat, especially fires involving fuel, can be a terrifying experience with the potential to cause serious injury. It is essential for all boat users to have an understanding of the principles of fire, the correct use of extinguishers and most importantly, the prevention of fire on board vessels.

It is a fact that fuel fires aboard small vessels spread rapidly, generate intense heat and can overwhelm those on board. Few people are able to successfully fight a fire aboard a small vessel, therefore prevention is essential and this is mainly done by good housekeeping.

Understanding Fire

Fire is a rapid chemical reaction producing energy in the form of heat and light and most people don't realise that when combustion occurs in a solid or liquid it is not the actual material burning but the vapour given off as the combustible material heats.

Oxygen, fuel and heat in their proper proportions are the basic components of combustion. The fourth component is the chemical flame chain reaction which is the rapid formation and consumption of certain atoms during combustion. If any of the 4 components are removed or interrupted, fire cannot exist and extinguishment will occur.



Extinguishing Methods

The four methods of extinguishing a fire are directly related to the 4 components. To extinguish a fire you need to be able to

- Cool – by reducing the temperature so that the temperature falls below the ignition point of that material
- Smother – if oxygen is excluded or limited from a fire the combustion process cannot continue
- Starving – by removing the combustible material itself or letting total consumption take place
- Inhibiting the Flame Chain Reaction – Certain chemicals have the ability to interrupt the chemical reaction taking place.

Flammability

All flammable materials have varying ranges of flammability. If too much or too little fuel is present (the concentration in air) burning will not take place but it is the materials that have a wide range of flammability that are most dangerous eg Acetylene has an upper and lower flammability limit of 2% and 80% respectfully making it extremely volatile. Petrol and Diesel have flammability ranges of approximately 2% - 8% but the fuel needs to be warm enough to give of vapours. This happens with petrol at about -40^{o}C but diesel needs to be heated to >60^{o}C.

Types of fires

Fires involving various types of combustible matter (fuel) are divided into classes so that an appropriate extinguishing medium may be chosen.

Class A – Ordinary Combustible Material.

Fires which involve ordinary combustibles (wood, textile, plastic, paper etc) requires the cooling effect of water. Water is best applied in a spray or fog pattern as the increased surface area of the droplets can absorb heat quicker forming steam. Once steam is formed it occupies seventeen hundred times its original volume assisting in the displacement of oxygen thereby extinguishing the fire by smothering and cooling. Plastics cover an extremely wide range of products most burn with terrific intensity, are highly combustible, and the products of combustion smoke, gases and fumes are highly toxic. Some of the common plastic items found on boats include nylon, polystyrene, polyethylene and PVC in the form of windows, sporting goods, battery cases, electrical insulation, hull, cushions etc. and the gases produced include

hydrogen cyanide, hydrogen chloride, benzene, carbon monoxide - all being capable of causing death within minutes.

Class B – Flammable Liquids
Fires involving petrol, diesel, kerosene, fats, etc are extinguished by the exclusion of oxygen or interfering with the flame chain reaction. This can be achieved by a blanket forming medium, like foam, which floats on the surface of the fuel eliminating the vapours of the fuel. A fire blanket works on the same principle and is a recommended acquisition of all households. Due to the risk of spreading the fire you should not use water on flammable liquid fires. Although not the best, a dry chemical powder extinguisher can be used with care not to spread the fuel by the force of the extinguishing medium being discharged.

Class C – Flammable Gases
This classification includes liquefied gases like LPG, methane, propane etc and these fires are extinguished by the removal of fuel by turning off the valve, crimping a supply line or letting the supply run out. It is most important with these fires to ensure the cylinders' internal pressure is reduced by cooling with water.

Class D – Metal Fires
Most metals will burn, some more intensely than others and at a range of temperatures and conditions. For each metal a specially designed extinguishing agent is required.

Class E – Electrical Fires
Electricity itself does not burn but an electric arc or short circuit may cause a fire in any of the above classes. In the case of electrical fires, if possible, first isolate the power supply and then treat as a normal fire. If isolation of the supply is not possible remember that water conducts electricity and a different extinguishing medium should be utilised.

Fire Extinguishers
Speed is of the essence and the hotter the fire the harder it is to extinguish but correct use of an extinguisher will effectively prevent a small fire getting out of control.
The advantages include

- Quick action
- Portable
- One person operation
- Located close to but **not next to** the hazard

Disadvantages include

- Short duration
- Not universal
- Reliability suspect

While each extinguisher works in a different way the general method is the same (PASS)

- **P**ull the pin
- Carry extinguisher to the fire
- Hold upright and **A**im nozzle at the base of the fire

- Squeeze the trigger handle
- Direct agent as recommended, usually in a Sweeping pattern
- Once used, even if not empty, they should be replaced or recharged ASAP.

There are five basic types and it is essential to identify the correct type for the class of fire and their method of operation. This information is displayed on each extinguisher and the colour coding is standard throughout Australia. If extinguishers are to be meaningful that should be readily accessible, of the right type and the occupants be familiar their mode of operation. Their location and use should be included with your safety brief at the beginning of each voyage and everyone who comes aboard your vessel must know how to react in the event of fire. You should also be familiar with the location of extinguishers around the buildings or areas you frequent.

ID SIGN	TYPICAL APPEARANCE	EXTINGUISHER TYPE (Cylinder Contains)	CLASS A Wood, Paper Textiles etc. (Normal Combustibles)	CLASS B Flammable Liquids Petrol, Paints	CLASS E Electrical Fires	CLASS F Cooking Oil, Animal Fats, Vegetable Oil
A:B(E) POWDER		DRY POWDER CHEMICAL	YES	YES	YES	NO
CO2		Co2 CARBON DIOXIDE	NO	YES	YES	NO
WATER		WATER	YES	NO	NO	NO
FOAM		FOAM	YES	YES	NO	NO
WET CHEMICAL		WET CHEMICAL	YES	NO	NO	YES

All RED – Water (A Class)
Direct stream at base of fire and can be used intermittently
Extinguishes by cooling, readily available and cheap

All BLUE or RED with BLUE BAND – Foam (AFFF) (A & B Class)
Direct stream over entire burning surface so it falls like flakes of snow
Foam floats on most flammable liquids forming a vapour proof layer which prevents reignition

RED with BLACK BAND – Carbon Dioxide (CO_2) (B & E Class)
Discharge close to fire moving nozzle from side to side
Extinguishes by smothering and displacing oxygen, effective in confined spaces
After use ventilate confined areas well before entering

RED with WHITE BAND – Dry Chemical Powder (DCP) (A, B, C, E Class)
Direct powder above the base of the fire in a rapid, side to side sweeping motion
Extinguishes by smothering and interrupts the chain flame reaction

They are the most popular as they are inexpensive, easy to use and easily replaced. **WARNING -** the powder can tend to settle effecting use so it is recommended to invert and shake the extinguisher regularly to loosen the powder.

Maintenance

- Be aware of corrosion
- Check gauge regularly
- It is an offence if the extinguisher is not maintained in a serviceable condition.

REMEMBER, there is no point in having a fire extinguisher if it malfunctions at the time of an emergency or you don't know how to use it. Ensure you can get to it quickly in the event of a fire and store it on a visible location between the risk and the exit.

Prevention

About half of boat fires are caused by electrical problems although hydrogen from batteries and fuel vapours account for many of the more explosive fires on board. Just because it may be a 12 volt system it doesn't mean the risks are any less and it won't cause a fire. All electrical work should be carried out by a licensed electrician to be sure that it is intrinsically safe.

Like LPG, petrol vapours are heavier than air so vapours may accumulate in the bilge. So before starting your engine, lift the cover and smell for fumes, particularly after refuelling. Electronic detection as well as checking with your nose can help prevent an explosion by an errant spark. A blower within the engine room should also provide adequate ventilation.

A cracked fuel or hydraulic line might cause an atomised spray of flammable liquid onto hot exhaust manifolds or turbo causing a fire to occur.

Prevention of boat fires is assisted by diligent housekeeping and common sense.

- Keep bilges clean of oil, fuel and dirty rags and degrease regularly
- Check fuel system before and during use for leaks or cracked lines
- Turn off all motors, appliances, engines etc and extinguish all flames before refuelling
- Check for vapours after refuelling and ventilate until clear
- Leave electrical or fuel system maintenance and repairs to trained personnel
- Always turn off gas at the cylinder
- No smoking on board or until after ventilation
- Wipe up all spills
- Never refill portable fuel tanks on board – always take them ashore
- Use only marine approved appliances
- Always be careful when cooking and don't leave cooking unattended
- Thoroughly check all systems after long unused periods
- Don't place batteries on charge for extended periods of time as they can over heat causing a fire

In the event of a fire on board

- **Seal area**
- **Issue life jackets**
- **Send out a distress call**
- **Shut down power**
- **Extinguish fire**
- **If necessary abandon ship**

And finally, if people sleep on board you should install smoke alarms.

Fires don't discriminate, it can happen to you

"In the end, it's all about taking due care and paying attention to the basics. There is no such thing as shortcuts when it comes to fire prevention. You need to make sure that your craft is in good condition, that all the wiring and fuel systems are up to scratch and that, most importantly, your fire-fighting equipment is ready to go. You also need to think about what you need to do in the event of a fire and, even more importantly, you need to educate your passengers about standard fire drills". (Club Marine)