



RSMA BEST PRACTICE GUIDE

PART 5 **Fire Safety**

CONTENTS

Section 1. Introduction.....	3
Section 2. Law and regulations	4
Section 3. What is fire?.....	6
Section 4. Fire extinguishers	9
Section 5. Fire risk assessment.....	12
Section 6. Fire prevention.....	16

Section 1. Introduction

1.1 Fire safety in the road marking sector can easily be overlooked. Road marking operatives constantly work with fire and flame, this may result in fundamental fire safety considerations being forgotten as operatives become more and more comfortable when working with naked flame.

The nature of road marking materials, equipment and working methods are such that naked flame is common place. This section of the Best Practice Guide is designed to illustrate fire safety considerations not only for road marking contractors and the crews operating on roads and other sites, but to provide a guide to others who may from time to time engage the services of such road marking contractors.

1.2 Yes the vehicle is on fire!

Those in control of a site and their health and safety representatives are often not expecting line marking vehicles, plant and working methods to involve naked flame, fire and associated smoke. Organisations who engage the services of road marking contractors must understand that when working with thermoplastic line marking materials, road stud grout, bitumen and hot anti skid treatments, the correct operation of plant and equipment relies heavily on the presence of some form of naked flame. It is often the perception of unfamiliar onlookers that the vehicle is on fire. Certain equipment can do appear to be 'on fire' during normal operation.

On sites where it is considered absolutely unacceptable to have a naked flame, alternative marking solutions should be considered. Where molten materials are selected, hot work permits may be required and equipment may be subject to specific fire safety inspections conducted by those in control of the site. However, under normal circumstances it is uncommon for road markers to be asked for such permits or to have the vehicle inspected in such a manner.



1.3 Hot works

The term 'Hot works' will be used in this publication and should be considered as anything related to the heating, applying and otherwise handling of molten materials used in road marking activities. The use of equipment designed to keep hand tools warm will also be referred to as hot works, as will any and all operations of plant and equipment heated using fire and naked flame.

1.4 Familiarity and complacency

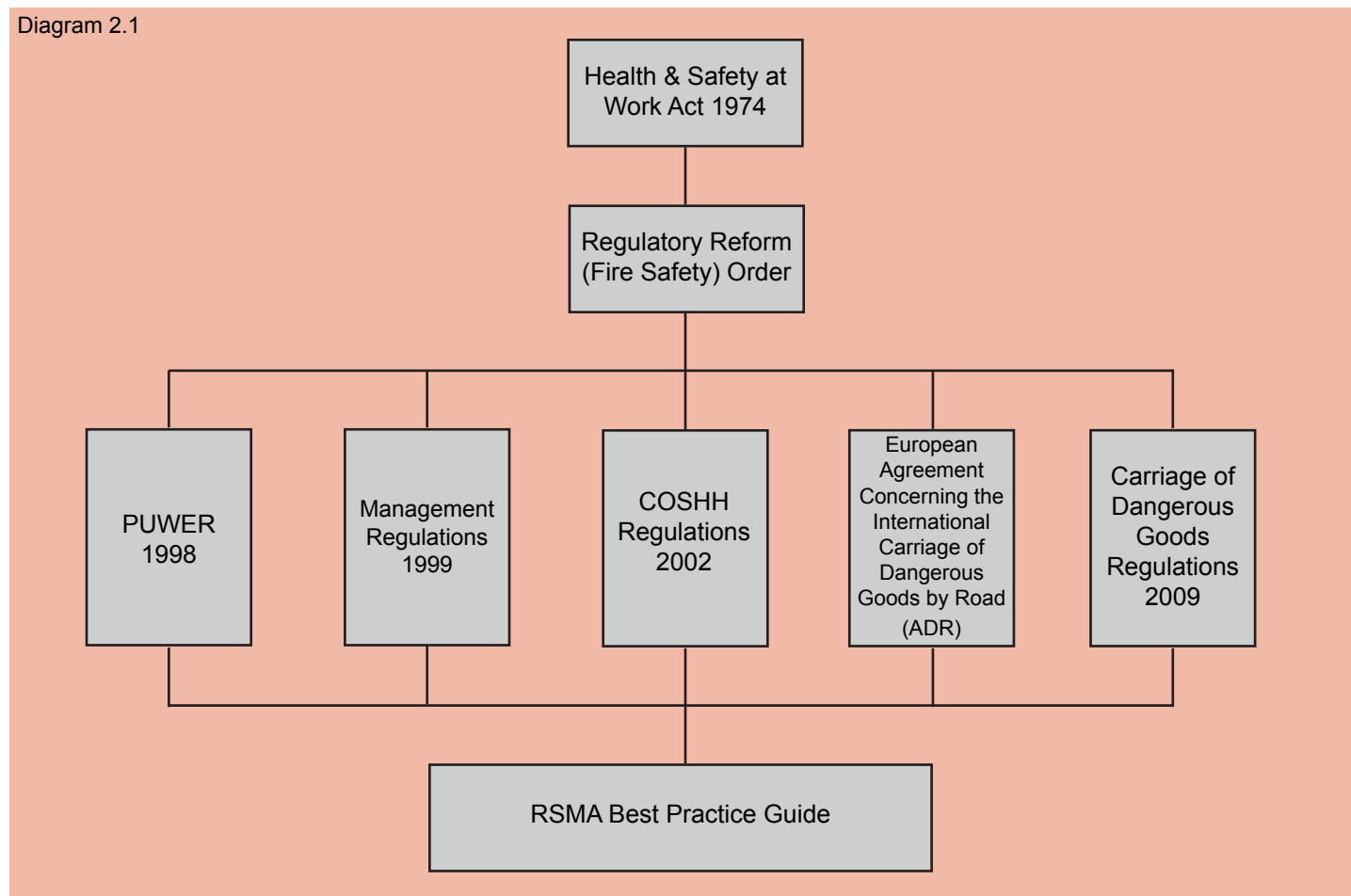
It may be considered very easy to become complacent when conducting road marking hot works. Everyday use of fire and flame may result in an unsafe familiarity when conducting hot works. It is recommended that ALL road marking organisations familiarise and refresh road marking operatives in matters of fire safety. This publication may serve as a reminder of many factors regarding fire safety and can form the basis of refresher sessions and toolbox talks.

Section 2. Law and Regulations

2.1 Laws and regulations

There are a number of specific pieces of legislation that may apply to fire safety within the road marking sector. The diagram below illustrates the main statutory instruments that affect the way a road marking contractor should conduct their work. The Health and Safety at Work etc Act 1974 and its statutory provisions remains the overriding enabling act with regards to health and safety at work. Additional legal instruments as referred to below will be used and referenced in this publication.

Diagram 2.1



2.2 Application of the law

Fire and its devastating effects are so severe that in 2005 the regulatory reform fire safety order was established to address issues relating to general fire safety in non-domestic premises.

The regulations noted above when applied in conjunction with each other will form a strong basis for fire safety. The bullet points below explain very briefly each piece of legislation and how it is practically applied to road marking fire safety.

- **Health and Safety at Work Act 1974**

Statutory requirements under various sections including section 2 and section 7 remain relevant regarding fire safety.

- **Regulatory Reform (Fire Safety) Order 2005**

Key elements of the fire safety order (FSO) are designed to reduce the burden of fire safety on businesses by simplifying the multiple, overlapping fire safety regimes. The fire safety order is one simple regime that applies to all work places and non-domestic premises. The regime is risk assessment based with the need for a defined responsible person being nominated for every organisation.

- **Provision and Use of Work Equipment Regulations 1998 (PUWER)**

PUWER regulations are covered in more detail in part one of the RSMA Best Practice Guide. It is clear that planned preventative maintenance regimes and effective pre-start checks help prevent unplanned and unwanted ignition of fuel sources.

- **Management Regulations 1999**

A full outline of the requirements under the Management Regulations 1999 can be found in Part One of the RSMA Best Practice Guide.

- **COSHH Regulations 2002**

Specific details regarding the storage and handling of substances hazardous to health is documented in Part 2 of RSMA Best Practice Guide. The safe handling and storage of substances that are described as 'highly flammable' and 'extremely flammable' such as LPG, petrol, diesel, solvents and thinners used in road marking activities will be covered in this section.

- **Carriage of Dangerous Goods Regulations and ADR**

This publication will use the Carriage of dangerous goods regulation and ADR as guidance on 'best practice' when applying provisions contained within the legislation. This is mainly due to the use of certain exemptions within the road building sector. Elements such as mixed load thresholds used to keep dangerous goods to a prescribed maximum and the number and type of fire extinguishers will be referred to in this publication.

2.3 Interpretation of the Regulatory Reform (Fire Safety) Order 2005

In order to provide a foundation for guidance within this publication, elements of the Regulatory Reform (Fire Safety) Order 2005 will be interpreted and applied to the road marking sector. The glossary of terms below should be used for interpretations throughout this publication.

Glossary of Terms

Competent person

All precautions provided would be subject to maintenance and would be installed and maintained by a "competent person" (as defined in the Order). The precautions to be maintained should include any provided for the use of fire-fighters in case of fire (e.g. fire-fighting shafts, access points, fire-fighting riser mains).

Fire precautions (general)

General fire precautions are considered as those precautions employed to prevent fire in basic circumstances where fuel sources such as Petrol, diesel and LPG are not used. This will include premises such as offices, warehouses and workshops. It will also encompass the cabs of road marking vehicles.

Fire precautions (special)

Special precautions will cover situations where flammable fuel sources are used to power plant vehicles and equipment. Precautions regarding the operation of LPG and diesel fired thermoplastic and bitumen boilers, mould and jug heaters and hand held LPG torches will be addressed.

Place of work

A place of work is defined as the work site, works vehicle and/or any other such location where the road marking activity is being carried out. This will be regardless of who is in control of the site.

Premises

Premises will be defined as any building or yard used by road marking organisations at any time to store, maintain and apply their normal business. The main focus however will be on the practical work conducted away from the yard and office.

Process fire safety

The process is defined as the actual application of road marking materials and will include the specific machinery used in the process. It is believed that the Regulatory Reform (Fire Safety) Order 2005 continues to be the right place to deal with 'process' fire safety (specific fire safety measures required to deal with risks arising from manufacturing processes) since the fire risk elements of road marking work processes need to be considered alongside other risks.

Responsible person

A 'Responsible Person' MUST be nominated. The responsible person is described as one who would be required to ensure that an assessment of the risk of, and from, fire is undertaken for the place and activity. Identified hazards would be removed or reduced so far as is reasonable and risks to persons avoided. Special consideration would be given to the risks posed by the presence of dangerous chemicals or substances and the risks that these pose in case of fire. Special consideration would also be given to any group of persons who may be especially at risk in case of fire, whether due to their location or any other factor. To protect persons, mitigation of the effects of a fire would be considered as part of the removal of risk and provision of protective measures (fire precautions)

Specific fire risk assessments

At the heart of any fire safety system is the requirement to carry out a specific fire risk assessment. This places the primary responsibility for determining what the risks are and how they will be minimised on the responsible person.

Vulnerable persons

Vulnerable persons will be considered as:

- New starters and trainees with little or no experience of road marking activities
- Employees not normally engaged in road marking activities
- Other contractors and visitors to site with little or no knowledge of road marking hazards
- Members of the general public
- Other road users effected by road marking activities
- Anyone else who may be effected by road marking activities

Section 3. What is Fire?

3.1 Fire used as part of the process

Fire and flame are an integral, and in most cases an essential part of road marking. Hot works will always be a necessity within the road marking sector, until such time as new technology replaces the need for molten thermoplastic, bitumen and associated materials. Indeed there are products available on the market today that will totally eliminate the need for fire, flame and heat sources but due consideration must be given to their inherent risks. However, it is not always reasonably practicable to use these alternatives. Thermoplastic materials are relatively cost effective and take only a few minutes to dry, resulting in shorter disruptions to traffic.

When fire and flame is suitably controlled and handled with respect by trained, competent operatives the risk of uncontrolled fire is kept reasonably low. If complacency leads to that respect being overlooked then mistakes have and will happen, resulting in devastating and sometimes life threatening situations.



3.2 Understanding fire

In order to suitably control 'process fire and flame' and to prevent the unwanted ignition of fuel sources. One MUST first understand the chemistry of fire. This is also important should an uncontrolled fire break out and require fire fighting by the crew of a road marking vehicle or the occupants of a building. It is important that only trained and competent people attempt to tackle a fire as the use of incorrect appliances and techniques will put the individuals in more danger. Those who do not understand how to correctly tackle a blaze should move away to a safe distance and call the fire brigade immediately by dialling 999.

NEVER ATTEMPT TO FIGHT A FIRE UNLESS YOU ARE ADEQUATELY TRAINED AND IT IS SAFE TO DO SO

3.3 The definition of fire

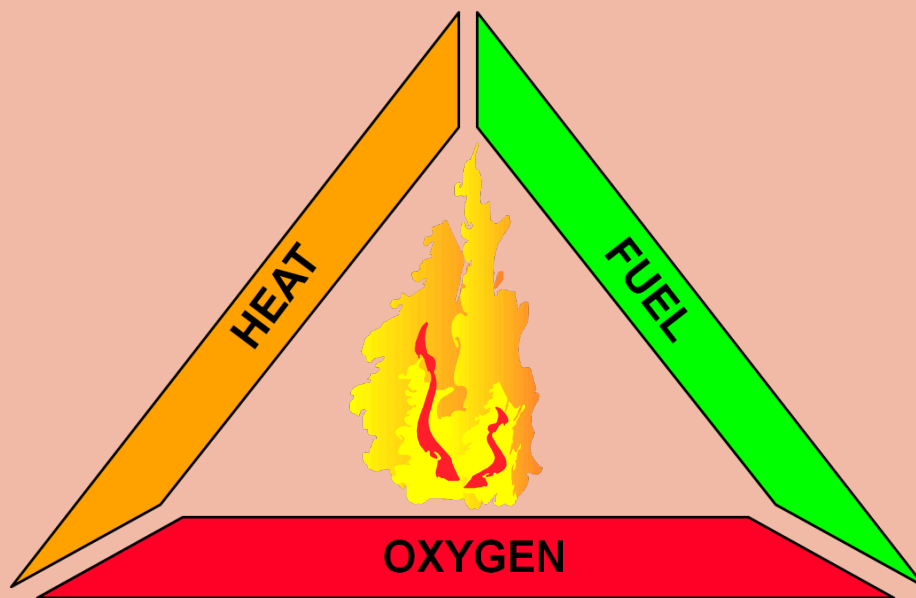
Fire is a chemical reaction producing, heat, light and toxic products of combustion.

Road marking activities involve all of the above. The key to fire safety is understanding how and why fire can get out of control. It is then important to apply a suitable fire safety regime to an organisations working practices in order to control fire hazards and reduce the risk to the business, its employees and all others who may be effected by the destruction and devastation of uncontrolled fire.

3.4 The fire triangle

In general terms a fire requires three components to be present. These three elements are shown in the diagram below:

Diagram 3.1



Fuel

Fuel sources are often restricted to the obvious flammable substances carried on road marking vehicles such as LPG, diesel, petrol and thinners. When conducting fire risk assessments it is easy to overlook other fuel sources such as wood from pallets, straight edges and templates, paper and plastic from waste packaging and/or stored materials, clothing and PPE, aerosols and the bodywork and fabric of the vehicle itself.

Oxygen

Fires need oxygen to burn. Generally an adequate supply of air is required to ensure the burners on material boilers work efficiently. When oxygen or air is not available the burner will not burn hot enough. This is the case with uncontrolled fires. Oxygen/air is difficult to remove from the equation as it is all around us, all the time. It should be noted that some substances may produce their own supply of oxygen when chemical reactions take place. These chemicals are not commonly found in road marking activities, however chemical safety data sheets (SDS) should be consulted at all times when new chemicals and substances are introduced.

Heat

The third element needed to start a fire is heat, or some form of ignition source. Road marking vehicles have obvious ignition sources for uncontrolled fires. These are the flames in boilers, mould and jug heaters and hand held gas torches. Less obvious and again often overlooked are heat sources from machinery, exhausts, friction from poorly lubricated gears and drives and sparks generated from faulty vehicle electrical systems.

An even more common ignition source for uncontrolled fire are discarded cigarettes. Most of the vehicle fires reported to the RSMA involve the vehicle cab and it is suspected that in most cases a discarded cigarette was the cause of the fire.

3.5 Flash point & fire point

It is important to understand the terms 'flash point' and 'fire point' as this can be an issue when thermoplastic, bitumen or HFS materials are over heated. Boilers containing materials are known to 'flash over' and start to burn within the boiler. Understanding what is going on in such situations can help prevent and tackle such unwanted fires.

Flash point

The lowest temperature at which a substance gives off sufficient flammable vapour to ignite momentarily when an ignition source is applied.

Fire point

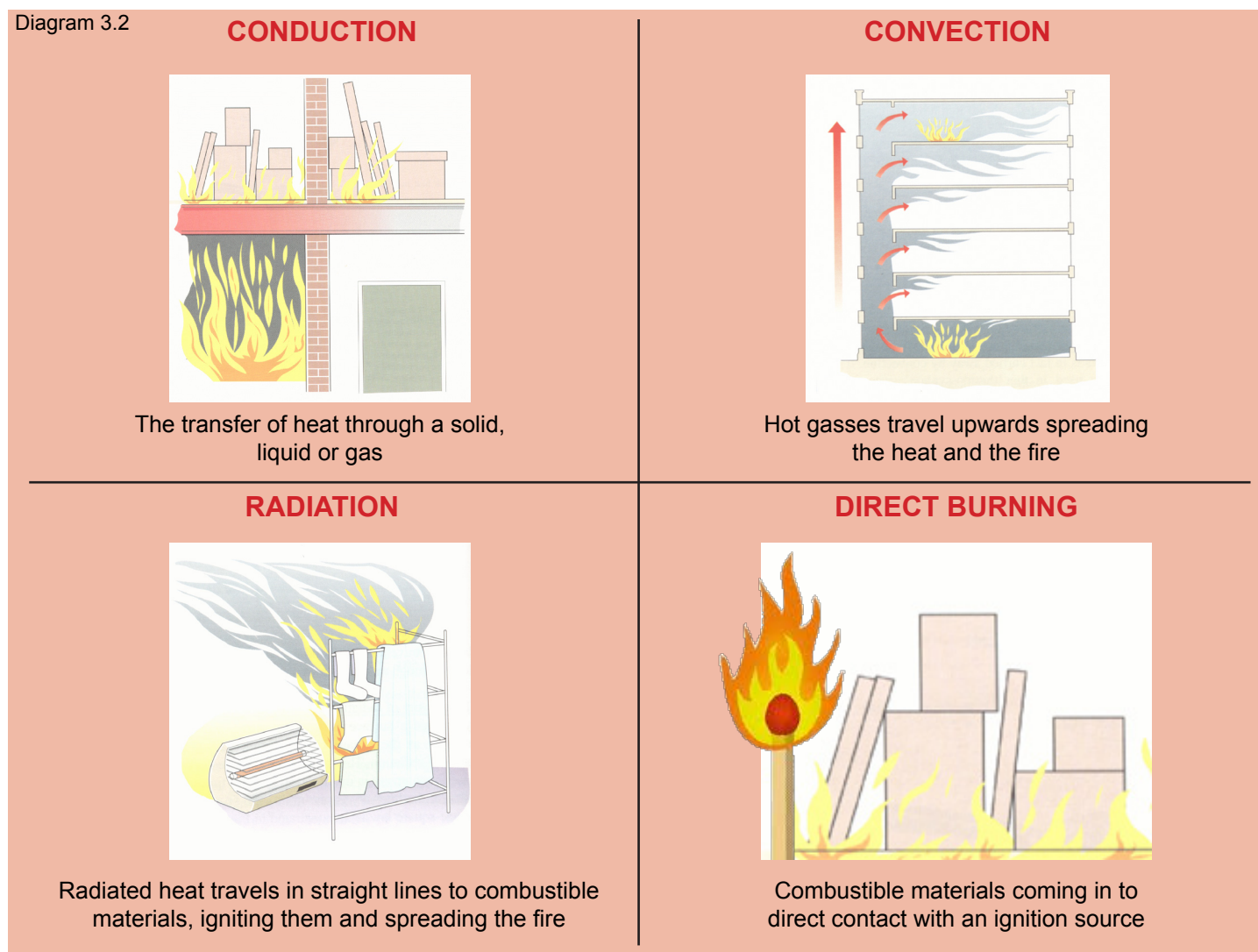
The lowest temperature at which a substance gives off sufficient flammable vapour to ignite and continue to burn when the ignition source is applied.

Plant and machinery used to heat materials and hand tools and equipment **MUST** not be left unattended.

Road marking materials are formulated and blended and have recommended working temperatures. Modern material boilers are fitted with thermostats, regulators and thermometers. When adequately serviced, maintained, calibrated and operated in the correct manner these devices can prevent the above mentioned situation from occurring. Effective fire prevention regimes will require pre-start checks to be carried out to ensure such devices are working correctly. Planned preventative maintenance and pre-start checks are covered in detail in part two of the RSMA Best Practice Guide.

3.6 How fire spreads

Fire is spread in four basic ways as illustrated in this diagram:



3.7 Classes of fire

Details regarding fire fighting and fire extinguishers will be covered in the next section of this publication. This section deals with all classes of fire. Fire marshals and fire wardens MUST have a working understanding of the classes of fires.

There are five (5) classes of fire. It is important to know what is on fire and how to extinguish it. The five classes of fire are:

CLASS A

Class A fires are fires involving 'Solids'. Combustible materials such as Wood, Paper, Plastics, Fibres and Rubber. These solids may be classed as common combustible materials

CLASS B

Class B fires are fires involving 'Liquids'. Flammable liquids such as Petrol, Oils, Paraffin, Paints and Acetone.

CLASS C

Class C fires involve flammable 'Gases' such as Acetylene, Propane, Butane, Hydrogen and Methane.

CLASS D

Class D fires are fires that involve volatile 'Metals' such as Magnesium, Sodium, Potassium, Titanium, Aluminium and Lithium.

CLASS F

Class F fires involve Cooking Oils and Cooking Fats.

Road marking activities mainly involve materials that fall into classed A, B & C. The following table shows common road marking materials and what class they would normally fall in to.

Table 3.1

CLASS A SOLIDS	Pallets. Lorry flatbed boards. Wooden side panels. Straight edges. Templates Plastic bags. Other packaging. Traffic cones. Buckets. Plastic fittings. Scrap material Hessian sacks. Clothing & PPE. Seats & seat covers. Dashboards. Road stud inserts. Tubing.
CLASS B LIQUIDS	Petrol. Diesel oil. Hydraulic oil. Engine oil. Cold applied paint. Thinners. Tack coat.
CLASS C GASES	Propane (LPG). Petrol vapours. Acetylene.
CLASS D METALS	Aluminium bodywork. Aluminium TM signs. Engine parts. Tanks
CLASS F COOKING OILS & FATS	Not applicable

Section 4. Fire Extinguishers

4.1 Fire extinguishers

The use of fire extinguishers to control a fire on a line marking vehicle should be considered as a last resort. Hand held fire appliances may not be substantial enough to bring a thermoplastic or bitumen fire under control. Further sections in this publication will explore examples of effective fire prevention regimes that will help prevent a fire.

4.2 Types of fire extinguishers

There are many types of fire extinguisher containing differed extinguisher mediums. These are designed to be effective and safe on various classes of fires. Using an incorrect type of fire extinguisher on certain fires may result in injury or death. The most obvious example of a danger is the use of a water type fire extinguisher on an electrical fire or water on a thermoplastic fire. It is therefore imperative that organisations who expect employees to use fire extinguishers provide adequate information, instruction and training as to their correct and safe use.

The four (4) most commonly found fire extinguishers and the types of fires they are safe to use on are shown in table 4.1. Types of extinguishers are identified by colour code and by labelling indicating what type of fire they are safe to use on.

Table 4.1

Types of Fire Extinguishers						
Extinguisher		Types of fire				
Colour	Type	Class A Solids	Class B Liquids	Class C Gases	Class D Metals	Class F Cooking Oils & Fats
	Water	✓	✗	✗	✗	✗
	Foam	✓	✓	✗	✗	✓
	Dry Powder	✓	✓	✓	✓	✗
	Carbon Dioxide (CO ₂)	✗	✗	✓	✓	✓

4.3 Dry powder extinguishers

Dry powder fire extinguishers identified by a blue label are the most appropriate type of fire extinguisher for use on a road marking vehicle. The table above clearly shows that the dry powder extinguisher may be suitable for all fire types that could be expected on a road marking vehicle. This publication takes best practice guidance from legal requirements set out in legislation such as the Carriage of Dangerous Good Regulations and ADR. Road marking organisations MUST review the legislation to ensure they are within specified limits to maintain ADR exemptions. The importance of carrying the correct type and quantity of fire extinguishers is extremely important due to the nature of the hot work undertaken it may be considered that extra fire extinguishers are needed. This of course would be subject to the finding of a specific fire risk assessment. ADR regulations state additional fire extinguishers are needed depending on the net mass of the vehicle. The table 4.2 below sets out minimum and recommended quantities.

As described in ADR 8.1.4 the provision in column C is higher due to the nature of the hot works. Those conducting specific fire risk assessments may wish to increase the number of extinguishers carried according to the quantities of flammable materials present on any one vehicle.

Table 4.1

A Vehicle (max permissible mass)	B Minimum dry powder fire extinguisher provision set out in ADR	C Road marking sector minimum recommended provision for hot works vehicles
Up to 3.5 tonne	1 x 2kg for cab + 2kg additional	1 x 2kg for cab + 2 x 9kg
Over 3.5 tonne and up to 7.5 tonne	1 x 2kg for cab + additional Total of 8kg (usually 1 x 6kg but other provision is acceptable as long as there is 1 x 6kg)	1 x 2kg for cab + 2 x 9kg
Over 7.5 tonne	1 x 2kg for cab + additional Total of 12kg (including at least 1 x 6kg)	1 x 2kg for cab + 2 x 9kg
Any vehicle carrying dangerous goods under the "small load" limit or carrying only infectious substances	1 x 2kg only	1 x 2kg for cab + 2 x 9kg

4.4 Extinguisher placement

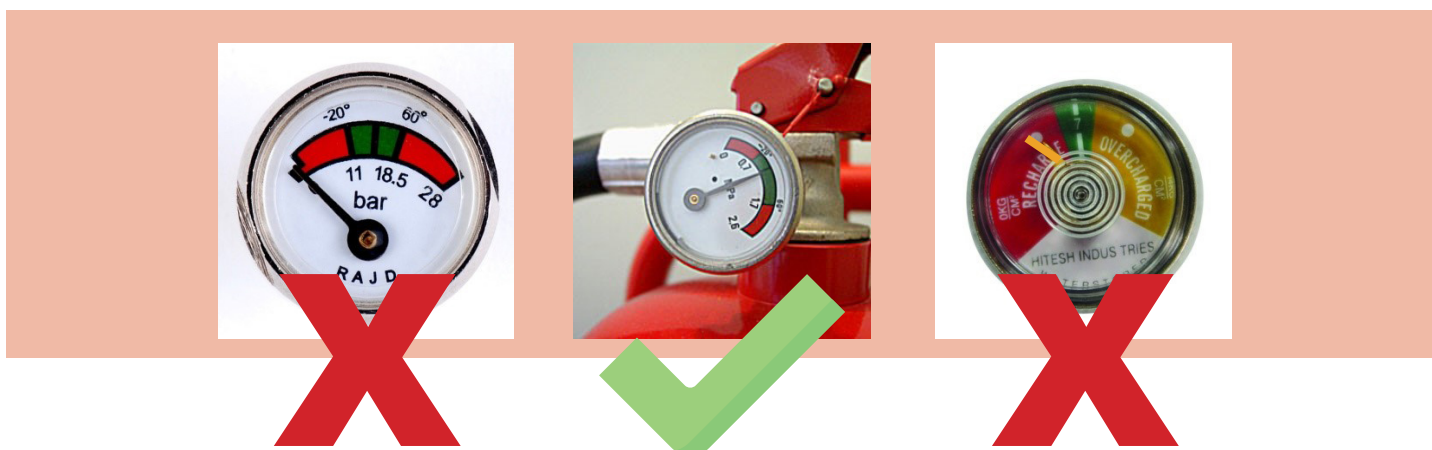
All fire extinguishers **MUST** be placed in suitable positions, secured for safe travel whilst being easy to get to in an emergency. Fire extinguishers in road marking vehicle cabs **MUST** be secured, easy to see and retrieve. Personal effects, work equipment and any other objects should not be placed on or around the extinguisher.

The same is true for extinguishers carried on the rear of road marking vehicles. Extinguishers **MUST** be clearly marked, specific carriers are available and are expected to be seen on a road marking vehicle. Additional signage, drawing attention to the location of fire fighting equipment is recommended. Specific extinguisher carriers **MUST NOT** be used to carry anything other than a fire extinguisher.



4.5 Extinguisher checks and inspections

Fire extinguishers **MUST** be inspected on a regular basis, such checks **MUST** be included in, and form a major part of all vehicle and equipment pre-start check regimes. Checks should be recorded and immediate action taken if extinguishers are found to be defective. Modern extinguishers are fitted with gauges designed to indicate the charge condition of the extinguisher. Those performing checks and inspections must receive appropriate information, instruction and training to ensure they are aware of how to interpret the reading on these charge gauges. The following pictures, along with this publication on fire safety are designed to be used as information for the basis of toolbox talks.



4.6 Extinguisher service and maintenance

Road marking organisations **MUST** engage the services of a professional fire safety contractor who is competent in the service and maintenance of fire extinguishers and other fire fighting equipment.

Fire safety contractors will provide information regarding the service intervals of specific appliances. Generally this is recognised as being every twelve months. Service and maintenance contracts should include repair and replacements to cover those that have been discharged or become faulty.

[illegible]

Section 5. Fire Risk Assessment

Your assessment regularly and check it takes account of any changes on site and anything specific to the road marking sector.

Risk assessments should take in to consideration the following factors.

Means of escape:

- **Routes.** Risk assessments should determine the escape routes required to evacuate a road marking vehicle to a safe distance.
- **Alternatives.** Alternative escape routes and methods should be considered.
- **Protection.** Fire protection equipment and materials should be assessed.
- **Assembly.** Vehicle crews should be given information, instruction and training as to where to assemble if a fire becomes uncontrollable.
- **Signs.** In general terms it would not be reasonably practicable to provide signs (Fire exit and assembly point) for road marking activities, however, Road marking operatives MUST understand what to do in the event of a fire.

Means of giving warning:

A system must be set up to alert people on site, which is simple to achieve on a fixed site or in depots, offices and buildings. Raising the alarm on transient road marking sites can be more of a challenge. Depending on the size and complexity of the site a warning could simply be the crew shouting "FIRE, FIRE, FIRE", alternatively, klaxons, air horns or whistles can be used to alert others. Whatever audible alarm is chosen it MUST be distinctive, audible above other noise and recognisable by everyone. Any system that relies on mechanical or electrical means MUST be subject to regular tests.

Means of fighting fires:

Fire extinguishers MUST be considered as part of a fire risk assessment. Section 4 provides guidance as to extinguisher types and locations. Risk assessments should acknowledge the risk to individuals when asked to fight fires with fire extinguishers. Specific people should be nominated and trained how to use fire extinguishers safely.

5.3 Road marking fire hazards

The table below lists common road marking fire hazards that MUST be considered when conducting a fire risk assessment. This list is not exhaustive and is meant as a guidance sample only. True fire hazard analysis can only be conducted whilst on-site analysing live situations. Table 5.1 below lists activities and perceived fire hazards in alphabetical order not in order of severity.

Table 5.1 Fire Hazards		
Arson	Poor security resulting in vehicles, equipment and premises being left in a vulnerable state.	High risk in unsecure locations allowing opportunity, resulting in damage to property and/or loss of life.
Boilers and Burners	Fuelled by LPG or Diesel. Operates at high temperatures and has naked flames present in most cases.	Unexpected ignition of fuel. Poor air supply leading to carbon monoxide being produced. Poor service and maintenance resulting in hazardous operations. Operated by untrained staff.
Diesel lines and hoses	Fuel leaks, poor connections, damaged lines and hoses.	Higher risk of unwanted ignition, loss of fuel resulting in added cost and environmental issues, spilled fuel resulting in slip hazards.
Diesel tanks	Not suitably secured on the vehicle, not inspected and checked on a regular basis, overfilled.	
Fire Extinguishers	Unserviceable extinguishers being carried on vehicles, No extinguishers being carried on the vehicle. Too few extinguishers available.	Extinguishers blocked or missing from their correct location, no competent operators, extinguishers not part of the vehicle pre-start checks. Resulting in an inability to stop a fire from spreading and destroying the entire vehicle.

Table 5.1 cont.		Fire Hazards
Flash-back arrestors (FBA)	FBA not fitted to LPG installations, FBA not tested and checked.	FBA by-passed when faulty, FBA removed and not replaced resulting in no safety protection should a 'flash-back' occur. No means to stop the resulting ignition from destroying the entire vehicle.
Friction	Gears and drives creating friction, drive belts too tight or too slack, bearings not sufficiently lubricated, sumps and reservoirs left to run low of lubrication oils and fluids.	Friction can create sufficient heat to cause combustion. Poorly maintained plant equipment may be the cause of fire that could destroy the equipment of the vehicle.
Fuel cans (Diesel)	Not suitably secured when travelling, lids and caps left off, incorrect containers used to store fuel.	Operators not aware of fumes and vapours, smoking whilst handling fuel and fuel cans, storing fuel cans too close to heat sources.
Fuel cans (Petrol)		
Housekeeping	Waste build up increasing the risk of combustion, equipment not returned to its place after use.	Debris on the vehicle results in obstructed escape routes, slip, trip and fall hazards, increased risk of debris being ignited, waste material and detritus masking leaks, damaged hoses or equipment resulting in a higher risk of ignition and uncontrolled fire.
Hydraulic systems	Un-serviced, unchecked and tested, running without pre-start checks could result in leaks and damage.	Hydraulic fluid leaking under pressure from lines and connections, spraying on to naked flame resulting in combustion and fire that could destroy the equipment or the vehicle.
Lighting boilers	No safe ignition systems fitted. No safe system of work present. No formal information, instruction or training in safe ignition of boilers. Ignition systems and safety devices by-passed or removed.	Uncontrolled escape of LPG and/or diesel resulting in a build-up of fuel that may 'flash-over' when ignition is attempted. Ignition safety systems by-passed resulting in the above when adverse weather extinguishes the burner flames.
LPG Cylinders	Not suitably secured when travelling, overfilled or stored too close to heat sources. Valves left open when not in use. Stored illegally in yards and depots.	LPG cylinders that are not secured on the vehicle may fall off and cause a major incident.
LPG Lines and hoses	Lines and hoses not subject to regular checks and tests for safety. No leak test activity, Lines and hoses positioned in vulnerable positions. Hoses and lines covered in debris that masks leaks and damage.	Leaking LPG hoses and lines not being tested, found and repaired will result in a higher risk of ignition and explosion, loss of LPG, time and money.
Manifolds and connections	Manifolds and connectors not subject to regular checks and tests for safety. No leak test activity. Incorrect fittings, clips and improvised adaptations.	Jubilee clips used instead of correct gas clips, resulting in over tightening or loose fitting connections allowing the escape of fuel sources resulting in a higher risk of fire and explosion.
Mould heaters and hot boxes	Not subject to regular checks and tests for safety. No leak test activity. Debris allowed to build-up in the hot box. Hot box not sited in the safest place.	Naked flame from the mould heater not controlled resulting in the ignition of fuel sources stored too close to the flame.

Table 5.1 cont.		Fire Hazards
Refuelling (Diesel)	No suitable safe system for refuelling. Refuelling whilst smoking. Overfilling tanks. Running other plant and equipment whilst refuelling.	Not following accepted safe systems for refuelling with diesel may increase the risk of ignition, fire and explosion.
Refuelling (LPG)	No suitable safe system for refuelling. Refuelling whilst smoking. Overfilling tanks. Running other plant and equipment whilst refuelling.	No formal information, instruction or training provided resulting in incorrect actions such as not correctly using the anti-static earth bonds as required to prevent sparks and ignition of gas and vapour.
Smoking	No smoking policies not used or enforced.	Smoking in vehicle cabs resulting in cab fires. Using work equipment as a cigarette lighter. Smoking whilst refuelling or operating hot works equipment. Smoking whilst handling fuel sources resulting in fire or explosion, destruction of property, injury or loss of life.
Spills and leaks	No formal housekeeping to enforce suitable controls or immediate clean up of spills and leaks. No adequate spills kits available along with suitable information, instruction and training.	Leaking fuel or flammable materials catching fire, causing explosions, slip hazards and environmental pollution issues.
Storage	Poor storage resulting in fire and explosion. Articles and substances being stored too close to heat and ignition sources. No formal storage area. Work area and escape routes un-identified on the works vehicle or on the work site.	Poor storage resulting in an increased risk to employees and others who may be exposed to resulting fire and explosion, articles and substances causing slip, trip and fall hazards.
Storage areas		
Thermostats and thermometers	Not subject to regular checks and tests for safe operation. No formal calibration to ensure the correct temperature is displayed.	Faulty thermostats and thermometers allowing materials to overheat, reach flash or fire point, causing damage to equipment, loss of material and higher risk of injury to operatives and anyone exposed to the flames.
Training	No formal or adequate information, instruction or training being given to new employees who are expected to work with hot work equipment. No formal fire awareness training. No formal fire marshal or warden training being given and no system to refresh training and prevent skills fade. Employees with little or no competence are at significantly higher risk of injury or loss of life due to fire, explosion or associated effects.	
Vehicle electrical systems	Vehicle maintenance activities not robust enough to prevent electrical system fire. Battery systems discharging sparks or flammable gas when charged. Old and degraded connections arcing and sparking	Vehicle with overloaded or overheated vehicle electrical systems are at higher fire risk. Battery maintenance and charging activities not being carried out according to correct safe systems resulting in fire or ignition of highly flammable hydrogen gas.
Work area	The work area on the vehicle and on site not being maintained in an adequate state to prevent uncontrolled fire or explosion.	Poor housekeeping; storage and handling; poor working areas and platforms; and blocked escape routes adding to the risk of injury, damage or loss of life in the event of a fire or explosion.

Section 6. Fire Prevention

6.1 Fire prevention measures

The basis of all fire prevention activity is performing a fire risk assessment as discussed in Section 5. If the risk of fire is not assessed and measured then the effects of fire cannot be predicted or estimated.

Other fire prevention or control measures will be highlighted by the risk assessment. Step 3 of the fire risk assessment process asks for the hazards and people identified in steps 1 and 2 to be acted upon to remove or reduce the risk to protect people, premises, equipment and vehicles. This section gives examples of fire prevention measures that could be used.

6.2 Eliminate the fire risk

Where possible the fire risk should be eliminated. This is always going to be a somewhat difficult task in the road marking sector as the most cost effective materials rely on hot works. The key to fire safety is to eliminate or avoid unwanted combustion. Suitable systems **MUST** be in place to help manage the use of fire, flame and heat so that the risk of destructive uncontrolled fire is eliminated. Where total elimination is not possible the risks **MUST** be suitably evaluated and reduction methods acted upon.

6.3 Substitute the articles and substances that are high risk

Alternative cold applied materials are available, however as discussed earlier it is not always reasonably practicable to use these types of materials in all cases. Other substitutes such as the use of diesel fuel rather than LPG could reduce the risk of LPG materials for boilers causing flash-over and explosions. The burner and flame elements of this type of equipment are enclosed, ignition is done by remote power control and auto ignition systems.



6.4 Change work methods or patterns

Work patterns and methods can be changed to encourage safer activities. However established work patterns may be difficult to change and custom, as regular practice can often create a resistance to change making it difficult to find safer ways to carry out hot works.

6.5 Eliminate or reduce exposure time

Aimed more at those who may be affected by hot works such as pedestrians, other road users and the general public. Reducing the exposure to hot works can reduce the risk of incidents and adverse events. Road marking operatives are exposed to fire and flame constantly throughout their working day so this control method may not be appropriate in all cases.

6.6 Engineering controls

Engineering controls are one of the more effective methods of controlling fire, flame and ignition within the equipment and methods used to apply road markings. Well serviced equipment, effective pre-start checks and regular assessment of fire risk will ensure the equipment remains safe to operate. Many burners and hot works systems are fitted with safety devices such as flash-back arrestors, thermal cut-out switches and automatic control and ignition systems. These safety devices **MUST** not be by-passed or in any way tampered with as this is not only dangerous but is against the law.

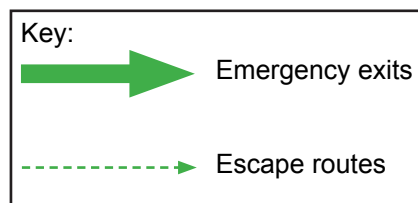
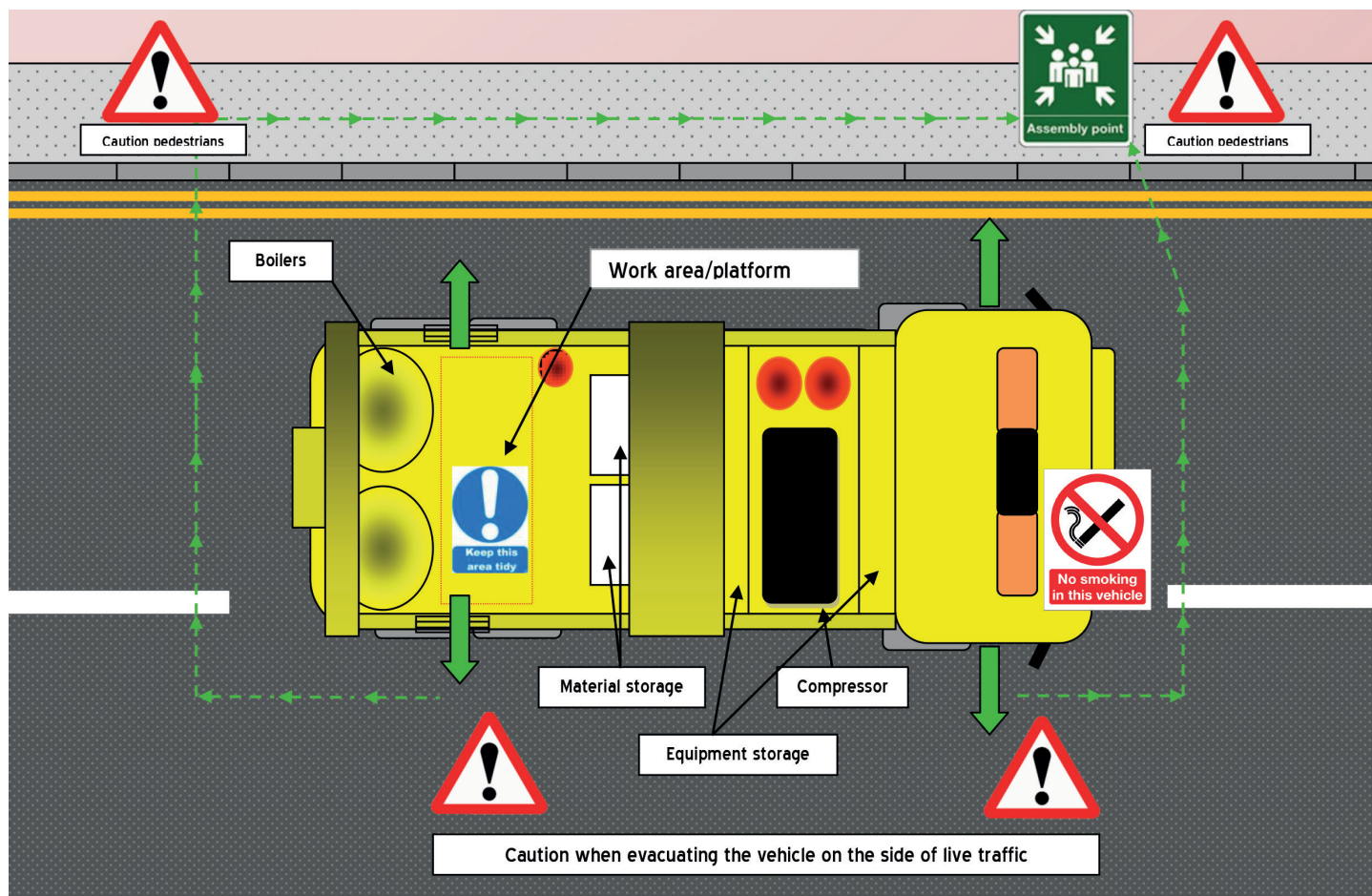


6.7 Good housekeeping

Good housekeeping is extremely important when working with naked flame, untidy work areas and accumulated debris and waste materials are well known as high fire risks. Work areas, storage areas and equipment MUST be arranged in the safest and most appropriate manner, this will help reduce the risk of uncontrolled fire. Equipment not stowed correctly will constitute a trip hazard and may block escape routes and create not only a dangerous situation but one that is in breach of legal requirements. A safe place of work, safe work platform, safe escape routes and safe access and egress points are requirements of many pieces of legislation, not only the RRFSO.

The diagram below shows how the back of a standard road marking vehicle could be segregated to ensure good housekeeping is maintained. **‘Everything has a place and everything in its place’** is a statement that epitomises good housekeeping. It is recommended that all road marking companies produce such a diagram to assist in assessing the housekeeping, fire safety and working at heights risks of their vehicle or any other vehicle in the fleet.

Example of a vehicle layout diagram for training and information to vehicle crews



On discovering an uncontrolled Fire:

1. Raise the alarm by shouting FIRE, FIRE, FIRE
2. Call the fire service (dial 999)
3. Fight the fire (if it is safe to do so)
4. Evacuate the site to a safe assembly point
5. Keep members of the public at a safe distance
6. Keep other vehicles at a safe distance
7. Do not approach the vehicle until it is safe to do so
8. Call the office and report a fire

Examples of poor housekeeping practices

The following pictures are examples of poor housekeeping that could increase the risk of fire and the likelihood that operatives could not safely and quickly escape from the vehicle.

Diagram 6.1



Access and Egress blocked by equipment.

Emergency escape via ladders blocked by cones and debris.



Access and Egress blocked by equipment.

Untidy work platform and Emergency escape via ladders blocked by cylinders and straight edges (trip hazards)



Materials and equipment not stowed effectively result in added trip hazards on the work platform.



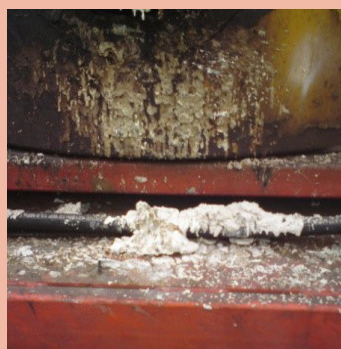
Materials and equipment not stowed effectively resulting in added trip hazards on the work platform.



Flammable liquid and oil bottles wedged into LPG cylinders.

Equipment and debris left on LPG Cylinders

This situation resulting in no access for safety checks and leak testing of cylinders, lines, valves and connectors.



Material Debris allowed to build up on hydraulic lines.

This situation may damage the lines or mask any potential leaks that occur

6.8 Safe systems of work

Safe systems of work are essential when conducting hot works. Following prescribed working methods that have been assessed for safety will ensure incidents and adverse events involving fire and hot works are well controlled. Specific information regarding the development of a safe system of work can be found in this publication.

6.9 Training and information

Information, instruction and training is an important factor regarding fire safety. The legal requirement of having a competent person and a responsible person results in the need for effective fire safety training. Such training extends to all employees of an organisation. Operatives should receive effective training in fire awareness and fire prevention. More senior operatives, team leaders and supervisors may be asked to become fire marshals or fire wardens, with each role requires specific training. New employees **MUST** have induction training that covers what to do in an emergency situation. The level and complexity of training depends greatly on the size and specific needs of the business, however training is a must for all organisations regardless of how big or how small they are.

Information regarding the company policy on fire, fire evacuation and fire fighting **MUST** be communicated to the workforce in an effective manner. Regular toolbox talks and briefing sessions focussing on fire safety is essential. This publication can be used as a basis for toolbox talk content

Specialist training may be required for those who wish to encourage employees to use fire extinguishers and participate in specialist fire prevention activities. The RSMA is able to assist in the sourcing of specialist fire related courses.

It is widely accepted that those expected to use fire fighting equipment **MUST** be suitably trained and competent to do so, indeed the law requires effective training to be done in this area.



6.10 Monitoring, supervision and review

All safe systems of work **MUST** be subject to regular monitoring, supervision and review. This can be done either by the competent, the responsible person or by a safety committee trained in fire safety. Audits by external organisations often highlight otherwise unforeseen situations. A fresh eyes approach to fire safety inspections and audits will remove familiarity and complacency.

Safe systems of work **MUST** be reviewed on a regular basis, the recommendation is a minimum of every twelve months. It is however recommended that audits and inspections are performed more often. This is due to the heavy reliance upon hot works within the road marking sector. All safe systems of work including method statements **MUST** be reviewed and updated whenever an accepted work practice is changed or when new procedures, methods or equipment are introduced.

New and existing road marking vehicles **MUST** be subject to specific fire risk assessments. Vehicle and plant manufacturers should conduct fire related research and design and build vehicles and plant with fire safety in mind.

