

Flammable Liquids

Understanding the Risk

Regardless of the flashpoint (FP), when a flammable liquid becomes involved in a fire it will contribute greatly to the severity and spread of fire. The FP is the lowest liquid temperature at which a liquid gives off vapours in a quantity capable of forming an ignitable vapour/air mixture.

Flammable liquids are defined in the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) as 'any liquid, liquid solution emulsion or suspension, other than aqueous ammonia and liquefied petroleum gas'.

The Health and Safety Executive categorises such liquids as follows:-

- Extremely Flammable - FP below 0°C and a Boiling Point of less than 35°C.
- Highly Flammable – FP below 21°C.
- Flammable liquids – FPs between 21°C and 55°C

The three main dangers associated with flammable liquids are:

- a) An explosion resulting when a flammable vapour/air mixture falls within their explosive limits;
- b) Fire involving the flow of burning liquid over a wide area;
- c) The rupture or explosion of unvented or inadequately vented containers.

The main causes of fires that involve flammable liquids result from:

- Inadequate maintenance;
- Misuse of equipment or disregard of safety procedures/regulations;
- Carelessness;
- Improper or inadequate design;
- Static electricity;
- Poor housekeeping

The Risk Assessment

To comply with the requirements of DSEAR, which came into force in July 2003, the flammable liquids should be the subject of a risk assessment. The assessment should be undertaken by a competent person and actions taken to eliminate or reduce the potential hazard. The risk assessment should include the following measures to ensure that the hazards have been adequately risk assessed and controlled:



- Establish the nature of all dangerous substances that are present, the quantities and what the fire and explosion risks are;
- Put control measures in place to either remove those risks or, where this is not possible, control them;
- Put controls in place to reduce the effects of any incidents involving dangerous substances;
- Prepare plans and procedures to deal with accidents, incidents and emergencies involving dangerous substances;
- Make sure employees are properly informed about and trained to control or deal with the risks from the dangerous substances;
- Identify and classify potentially hazardous areas. Hazardous areas are defined in DSEAR as 'any place in which an explosive atmosphere may occur in quantities such as to require special precautions to protect the safety of workers'. The hazardous areas should be classified into zones based on the frequency of the occurrence and the duration of an explosive gas atmosphere.

Zones

'Special precautions' as previously referred to by the DSEAR is generally taken to relate to the construction, installation and use of apparatus as given in BS EN 60079 part 10: 2015. The definitions of the zones requiring special precautions and the guidance on a time limit for which an explosive atmosphere may be present are as follows:-

Zone	Definition	Time h/yr
Zone 0	An area in which an explosive gas atmosphere is present continuously or for long periods	More than 1,000
Zone 1	An area in which an explosive gas atmosphere is likely to occur in normal operation.	10 to 1,000
Zone 2	An area in which an explosive gas atmosphere is likely to occur in normal operation and if it occurs, will only exist for a short time.	Less than 10*

*but still sufficiently likely as to require controls over ignition sources

Controlling the Hazard

The possibility of eliminating the risk, by substitution with a non-flammable alternative or an alternative having a FP above 55°C., should always be thoroughly investigated.

Ventilation

Either natural or mechanical means should be sufficient to prevent the concentration of the liquid below its lower explosive limit (LEL).

Stores should be at or above ground level unless mechanical ventilation is provided.

Ventilation openings should be at high and low level direct to the outside.

Mechanical ventilation should provide a minimum of six air changes per hour. Extract should be at low level and inlet at high level so as to provide cross-flow. Fan motors should be suitable for the hazard zone. Mechanical ventilation systems should comply with BS 5925:1991

Ignition

Sources of ignition should have been removed and electrical equipment in the area should be appropriate for the risk category or zone.

Potential sources of ignition should be identified and either removed or operated at temperatures well below the auto-ignition temperatures of the liquid.

Heating should be appropriate for the hazard zone.

The potential risk of ignition due to a build-up of static electricity should be assessed and measures taken to eliminate it.

Fork-lift trucks should be certificated to the appropriate zone.

Containment

The liquids should be in suitable containers. Spillages should be contained and prevented from spreading. Bunds and drip trays should be provided where required. Empty containers should be properly managed.

Catchment areas (with capacities not less than 110% of the largest container in the bund or 25% of their aggregate capacity, whichever is the greater) are required to contain a possible flowing liquid fire.

Automatic cut-offs with over-fill alarms should be fitted to all enclosed vessels and to all vessels supplied by piped services as a precaution against overfilling.

Where tanks are stored inside a building consideration should be given to providing an emergency dump facility.

The containment of liquids will also reduce the potential risk of contamination to the environment.

Separation

The liquids should be separated from other stored materials including incompatible and potentially dangerous materials. Flammable liquids should be stored separately from oxidising agents or flammable gases.

Processing or handling of flammable liquids should preferably be in a detached building, where this is not possible it should be done in a compartment providing a minimum of 2-hours fire resistance.

Storage

All tanks, vessels and containers should be clearly marked to ensure that all personnel are aware of the contents and the potential hazards. The markings should comply with the Health & Safety (Safety Signs and Signals) Regulations 1996 or other applicable legislation as listed in Schedule 5 of DSEAR.

The quantities of flammable liquids kept in working areas should be kept to a minimum; the quantity should not exceed the requirements for the day or shift being worked. The amount being held should not exceed a maximum of 50 litres of highly flammable liquid or 250 litres of flammable liquids at any one time.

Where storage tanks are fitted with vent pipes they should be designed to release vapours in such a manner that they can disperse safely. A risk assessment will be required in compliance with DSEAR but generally a discharge height of 0.3m above the top of the tank and 3.0m above ground level should be adequate.

Transportation of materials

Small quantities of flammable liquids should always be transported in safety containers. When pipelines are used the supply should be by metered pumps and not gravity fed.

Quick-action shut-off valves should be provided at the dispensing point for use in an emergency. Stop valves should be provided to isolate the pump/s and close valves at the most remote point i.e. at the point of supply if possible. Consideration should also be given to interlocking the emergency stops with the activation of fire alarm systems and/or the operation of sprinklers.

Fire protection

All portable fire extinguishers should be of an appropriate type. Consideration should also be given to the provision of a fixed fire fighting system e.g. sprinklers with foam additives and/or an automatic fire detection system.

In zoned areas the systems should be intrinsically safe and appropriate for the zone.

References:

FPA Recommendations for fire safety in the storage and use of highly flammable and flammable liquids

Dangerous Substances and Explosives Atmosphere Regulations 2002

BS 5925:1991: Code of practice for ventilation principles and designing for natural ventilation

BS EN 60079-10:2015 - Explosive atmospheres. Classification of areas. Explosive dust atmospheres

NFPA 30: Flammable and Combustible Liquids Code

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