



Flammable Liquids

Risk Bulletin

The flammability of a liquid is defined by its Flash Point. This is the minimum temperature by which the liquid must be maintained such that the vapour will be within the flammable range in air and can therefore be ignited and will generate a flame. It is the vapour above the surface of the liquid that burns.

Flash points for common solvents can be low and therefore these liquids under normal ambient conditions will always support a flame and are therefore deemed to be flammable. Anything with a flash point less than 37.8C is classified as being Flammable by NFPA and less than 60C for UK and Europe. Regardless of the classification what actually matters though is if the material is being handled above its flash point.

Examples:

Ethanol (fp. 14C), Iso Propyl Alcohol IPA (fp. 22C), Acetone (fp. -20C)
Methanol (fp. 12C), Gasoline (fp. -43C).

Therefore if a flammable liquid is above its flashpoint i.e. temperature, the vapour will burn if an ignition source of sufficient energy is introduced to the vapour. This principle forms the basis of controlling flammable risks by either controlling the concentration of the vapour or the potential ignition sources. The practice by which this is done defines the “Basis of Safety” for the operations.

Liquids with a flash point above 37.8C or 60C are deemed as being combustible. This means that they will still burn but have to be heated to above this temperature. Clearly in a fire this could happen and combustible liquids will then add to the fire load and result in escalation of the fire. Diesel is a great example of this with a flash point of 52C, so under normal conditions it won't catch fire but it clearly burns when heated. In an engine this is achieved by the compression of the air and fuel and therefore heating of the air fuel mixture. It should also be noted that combustible liquids in a fine spray or aerosol will burn even if they are below their flash point. This is of particular interest when related to leaks from hydraulic oil systems.



“Keep It in The Pipe”

Liquids by their very nature if spilt will occupy a large area and flow to the lowest point. If these liquids are flammable and above their flash point they represent a significant fire risk. The initial fire can easily spread to other areas. If large amounts of other flammable materials are stored in close proximity then the fire can rapidly engulf a building leading to complete loss if not adequately controlled. The calorific value of flammable liquids is very high and temperatures of circa 2000C are possible leading to failure of steel structures.

Containment does therefore provide our first layer of protection:

There should be adequate containment for spills from drums and tanks typically 110% of the largest container. This can be through impervious concrete bund walls or through drip trays and smaller proprietary drum bunds that will contain any spills.

Drips and spills can occur during normal filling, emptying and connection to pumps etc. The use of open buckets is not recommended and sealed containers should be utilised.

Dry break couplings may be utilised to prevent spillages from hoses. Drains should be installed to route any flammables outside of the main areas and be contained within a designated containment tank.

Drums should be appropriate for the duty and approved for use.

Plastic drums and in particular IBC's should be avoided wherever possible for flammable liquids.

There are numerous sources of information and best practice guidance found in the following.

For the storage of flammable materials the guidance found in HSG 51 The Storage of Flammable liquids in Containers and in HS(G)140 Safe use and handling of flammable liquids, HSE, 1996 which provide up to date advice and should be used as an initial starting point.

Risk Authority

RC55 RECOMMENDATIONS FOR FIRE SAFETY IN THE STORAGE, HANDLING AND USE OF FLAMMABLE AND HIGHLY FLAMMABLE LIQUIDS.

RC56 RECOMMENDATIONS FOR FIRE SAFETY IN THE STORAGE, HANDLING AND USE OF HIGHLY FLAMMABLE AND FLAMMABLE LIQUIDS: STORAGE IN CONTAINERS OTHER THAN EXTERNAL FIXED TANKS

Storage of flammables needs to be such that they are in a designated area with specified controls and protected from vehicles and people to prevent any potential for spillage through impact.

Smaller volumes such as in Lab areas should be via the use of closed fire proof cabinets with a 60mins fire rating.

Zones

Assessing how far the vapour will extend and therefore the extent of the flammable area is termed the Zone and is defined by the potential for a flammable atmosphere to be present.

Hazardous areas are classified into zones based on an assessment of the frequency of the occurrence and duration of an explosive gas atmosphere, as follows:

- Zone 0: An area in which an explosive gas atmosphere is present continuously or for long periods;
- Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation;
- Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it occurs, will only exist for a short time.

Various sources have tried to place time limits on to these zones, but none have been officially adopted. The most common values used are:

- Zone 0: Explosive atmosphere for more than 1000h/yr
- Zone 1: Explosive atmosphere for more than 10, but less than 1000 h/yr
- Zone 2: Explosive atmosphere for less than 10h/yr, but still sufficiently likely as to require controls over ignition sources.

The assessment of the extent of these zones is covered extensively under the use of BS EN 60079-10: 2003.

This assessment is often carried out as part of the ATEX Regulations and DSEAR (Dangerous Substances and Explosive Atmospheres Regulations) in the UK. This will provide a series of Hazardous Areas Classification drawings which will show the extent of the zones due to the handling of flammable material. This defines where a flammable atmosphere could occur and therefore where the control of ignition sources is required.

The extent of the hazardous area can often be reduced through the use of forced or natural ventilation. This is particularly useful when the vapour densities of the liquids are denser than air.



Control Ignition Sources

The Energy required to ignite a flammable vapour is usually less than 1mJ. This means that under all typical working environments there is sufficient energy through hot works, electrical systems, static electricity, vehicles, batteries etc. to ignite a flammable liquid. Therefore the control of ignition sources is absolutely essential as leaks and spills can never be fully eliminated.

If a substance is above its flash point and the vapour comes into contact with a spark or naked flame it will ignite. Ignition sources as stated are present from multiple different sources and should be assumed to have sufficient energy to ignite the vapour.

Key control measures that need assessing are:

- Electrical items such as lights, motors, switches, control panels, junction boxes etc. should be adequately EX rated for the designated zone and flammable vapour. EX is a term which defines equipment that has been specifically designed and tested for the use in a hazardous area.
- Vehicles such as Fork lift trucks and pallet trucks need to be EX rated. This is often provided by proprietary equipment from specialist companies.
- Earthing to all main plant items and equipment to less than 10 Ohms. Metal equipment can become charged and generate sparks through charge accumulation, earthing prevents the generation of sparks.
- Fixed Earthing points provided when filling/ emptying drums of flammable material.
- Earthing of flexible hoses to ensure any non-conducting materials don't act as insulators for metal components within the system.
- Ensure people are earthed via antistatic shoes and clothing. People can build up an electrostatic charge which is capable of igniting flammable vapours. This is particularly important when people are decanting, filling or emptying flammable liquids from drums and containers when they are in close contact with the vapour.
- Ensure battery charging equipment and any connection to batteries is not performed within a zoned area.
- All portable appliance phones, drills, tools etc either wired or battery operated need to be EX rated.
- Strict control of hot works which look at spark generating or naked flames activities.

