

Guidance note on electrostatic safety in the handling of flammable liquids

February 2019

1. Purpose

This guidance document highlights the main electrostatic hazards associated with handling of flammable liquids in product manufacturing sites, together with sources of information to assist with safe handling to avoid fires through static ignition of flammable atmospheres.

2. Field of application

All flammable liquids handled in coatings and printing inks manufacturing sites, as raw materials, finished products or others. This guidance applies to flammable, highly flammable and extremely flammable liquids, unless specified otherwise.

3. Definitions

3.1 Flammable, Highly Flammable and Extremely Flammable Liquids

According to EU legislation (see 5, Sources of information):

3.1 a flammable liquids have a flash point between 23 and 60°C

3.1 b highly flammable liquids have a flash point below 23°C and an initial boiling point above 35°C

3.1 c extremely flammable liquids have a flash point below 23°C and an initial boiling point of 35°C or below.

3.2 Lower Explosion Limit (LEL)

The lower explosion limit is the lowest concentration of vapour in air at which the vapour/air mixture is flammable.

3.3 Upper Explosion Limit (UEL)

The upper explosion limit is the highest concentration of vapour in air at which the vapour/air mixture is flammable.

3.4 Flash Point

Flash point is the temperature to which a liquid must be heated before it will produce a flammable mixture of vapour in air that will ignite when an ignition source is applied.

4. Electrostatic Hazards and Control Methods

This section lists the main electrostatic hazards associated with handling of flammable liquids (4.1) and the principal methods that may be used to control the risks that may arise (4.2). Guidance on the application of the control measures is given within the reference documents listed in section 5.

All users of flammable liquids should ensure that a risk assessment covering their specific operations has been made by a person(s) with an appropriate level of competence (this can be made by in-house person or external consultants). This risk assessment should meet the requirements of the ATEX User Directive 1999/92/EC (the ATEX '137' Directive), which is concerned with protecting the health and safety of workers potentially at risk from explosive atmospheres.

4.1 Electrostatic Hazards

Electrostatic hazards associated with handling of flammable liquids include but are not limited to:

- **Flammable atmospheres**
Produced when flammable liquids are handled at temperatures above their flash point with vapour concentrations between the upper and lower explosion limits (as defined in section 3).
- **Static charge (direct liquid handling)**
Static charge with sufficient energy to ignite a flammable atmosphere may be accumulated when directly handling flammable liquids via the following mechanisms:
 - Pouring**
 - Pumping** (includes discharging from tanks, vessels, road tankers etc.)
 - Spraying**
 - Splashing**
 - Mixing, stirring or agitating**
 - Filtering**
 - Transporting**
- **Low conductivity liquids**
Lower conductivity liquids are more susceptible to the generation of electrostatic charge when they are handled. A list of some commonly used lower conductivity liquids is listed in Annex 1.
- **Static charge (peripheral activities)**
Static charge with sufficient energy to ignite a flammable atmosphere may be generated and/or accumulated via the following peripheral activities when handling flammable liquids:
 - Movement of people, materials and equipment within the workplace**
 - Loading of higher resistivity solids in to a flammable liquid**
 - Charge accumulation on isolated conductors** (particularly hazardous as this can produce higher energy spark discharges at lower voltage potentials)
 - Charge accumulation on non-conductive materials** (includes tools, packaging, clothing, containers, pipework etc.)

4.2 Control methods

Principal methods to control electrostatic risks that may arise from handling flammable liquids include but are not limited to:

- **Limiting or avoiding the presence of flammable atmospheres** – Use local exhaust ventilation (LEV) to remove flammable vapours. See references in section 5 for methods to completely avoid flammable atmospheres
- **Earthing** – connect all conductive items to earth (metal plant, equipment, containers, structures etc)
- **Bonding** – connect adjacent metal parts and items to each other to ensure that they are at the same electrical potential (e.g. sections of pipe, structures, floor plates etc.)
- **Pumping flammable liquids at lower speeds** – preferably less than 1m/s
- **Pouring solids at lower speeds and/or using alternative loading methods** – preferably less than 1kg/s. See references in section 5 for alternative loading methods
- **Avoiding use of plastics in the workplace** – these may be a source of static charge and/or create a barrier to earthing of conductive items (e.g. tools, containers, equipment)
- **Provision of conductive or anti-static clothing** - to ensure that a barrier to earth is not created by this clothing and that it is not a source of static charge (includes footwear, gloves and overalls)
- **Provision of conductive flooring** to ensure that all personnel, equipment, containers, tools etc placed on or moved across the floor are connected to earth
- **Use of safer filling methods** – avoid free fall of solvents, direct solvent flow to the sides of containers, avoid splashing and spraying.
- **Installing Intrinsically Safe Plant and Equipment** – see references in section 5 for further information.

5. Sources of information

Principal reference:

- ESIG Best Practice Guideline, 'Flammability: A safety guide for users'
<https://www.esig.org/product-stewardship/solventwork/>

Other references:

- Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures ('CLP')
http://ec.europa.eu/growth/sectors/chemicals/classification-labelling/index_en.htm
- Directive 94/9/EC / Directive 2014/34/EU on equipment and protective systems intended for use in potentially explosive atmospheres ('ATEX'), and Directive 1999/92/EC on minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres
http://ec.europa.eu/growth/sectors/mechanical-engineering/atex/index_en.htm
- EuPIA Guidelines on loading high-resistivity powders into vessels containing flammable / explosive vapours
(in Workplace folder [Safety Advice for Printers and Printing Ink Manufacturers](#))
- IEC/TS 60079-32-1 Explosive atmospheres – Electrostatic hazards, guidance
<https://webstore.iec.ch/publication/60166>

EuPIA OSRA, February 2019
Replaces guideline of September 2007

Disclaimer

This guideline does not supersede any legislation in force.

This document is provided by EuPIA OSRA group solely to assist in promoting good practice in the industry and on the basis that it will be adapted and implemented by CEPE/EuPIA members for use in their organisations. EuPIA OSRA group gives no representation or warranty whatsoever in relation to anything written in the document or the compliance of any policy, recommendation or practice contained therein with applicable laws, regulations or best practice. EuPIA OSRA group shall have no liability whatsoever in relation to, or arising out of, the use of the document or the policies, practices or recommendations contained in it, or in any external links, by any third party. The document is provided on the strict understanding and on the basis that EuPIA OSRA group is not engaged in providing legal, managerial or other professional services in relation to its content.

Solvents conductance

Solvent	Conductance (S/m)
Citrosolv	
Hexane	$1 * 10^{-17} 2$
Isopar E	$3,0 * 10^{-12} 3$
Octane	
Heptane	$1 * 10^{-14} 2$
Xylene	$1 * 10^{-13} 2$
Solvesso 150	$1,0 * 10^{-9} 3$
Toluene	$8 * 10^{-14} 1$
Solvesso 100	$1,0 * 10^{-9} 3$
Solvesso 200	$2,0 * 10^{-9} 3$
Cyclohexane	$2,0 * 10^{-12} 2$
Pinewood oil	$10^{-12} 1$
n-Butylacetate	$1,12 * 10^{-8} 2$
Ethyl acetate *	$4,6 * 10^{-8} 2$

Sources:

¹ BGR 132

² Britton

³ BASF AG