

Paint Spraying and Other Painting Processes – Fire Safety

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Introduction

The application of paints and other similar coatings, whether by spraying, dipping or other process, can present fire or explosion hazards. These result not only from the solvent vapours that are emitted but also from mixed paint deposits which may be liable to spontaneous combustion from subsequent drying or baking processes.

The following recommendations provide guidance on the risk control measures which should be taken. Although they relate to the use of highly flammable liquid coatings with lower flash points (i.e. normally considered to be below 32°C), the general principles can be usefully followed for all flammable liquids. These recommendations are not applicable to powder coating systems.

Risk Assessment

In the United Kingdom, paint spraying activities are covered by the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR). Within these regulations, flammable and highly flammable liquids fall within the definition of a 'dangerous substance'. These Regulations require that, where a dangerous substance is present or likely to be present, a suitable assessment of the risks should be carried out and that measures should be implemented to eliminate or reduce the risks. Many of these measures are also relevant to property protection.

The main requirements of DSEAR are:

- Carry out a risk assessment of any work activities involving dangerous substances;
- Provide measures to eliminate or reduce risks as far as reasonably practicable;
- Provide equipment and procedures to deal with accidents and emergencies;
- Provide information and training to employees;
- Classify places where explosive atmospheres may occur into zones and mark the zones where necessary.

The risk assessment is to help decide what should be done to eliminate or reduce the risks from dangerous substances and should take account of matters such as the hazardous properties of the substances, the way they are used and stored, the possibility of hazardous explosive atmospheres occurring and all potential ignition sources.

The prime objective should be to eliminate flammable and highly flammable liquids from the workplace wherever possible (e.g. replacing them with non-combustible liquids or combustible liquids with higher flashpoints). Nevertheless, there will still be areas where dangerous substances could be used. In these situations, the objective should be to prevent the formation of hazardous atmospheres by control of the process, ventilation or containment. Within spray areas it is important, therefore, that the following recommendations are implemented.

Recommendations

Location

- The main principle is to site the process so that it does not present a threat to other areas and to segregate it so that if fire does occur then it can be more easily contained.
- Depending on the scale of the operation, it should be located in a separate building, room or compartment dedicated solely to this purpose. Any walls, partitions or doors to adjoining areas should be of at least 30 minutes fire resistance.
- Where such arrangements are not possible, or where the operation is on a small scale, then specially constructed booths should be used. Proprietary booths are freely available but booths can be produced in-house provided they are built of non-combustible materials. They should be large enough to enclose the whole of the article being coated and should, preferably, be located against an external wall.

The entrance to the spray area should be marked with the following sign.



Heating

- Heating should be provided by indirect systems such as hot water or steam radiators or pipes from a central boiler. Warm air ducted from heaters, operating on a heat exchange principle with the heater located outside the process area is satisfactory.
- Fixed electrical heaters of flameproof type are acceptable providing the surface temperature does not exceed 120°C and they are located where they are unlikely to receive paint deposits from overspray.
- Portable heaters of any type are not recommended and may be specifically excluded, under warranty, in your insurance policy.

Electrical Equipment

- The suitability of equipment used within zones for hazardous atmospheres should be assessed in accordance with British Approvals Service for Electrical Equipment in Flammable Atmospheres (BASEEFA), and should comply with The Equipment and Protective Systems for Use in Potentially Explosive Atmosphere Regulations 1996 and should also be categorised in accordance with Schedule 3 of DSEAR*. This includes fixed installations and wiring, plugs, sockets, clocks, radios, heaters, intruder and fire alarm systems and any equipment that may be used temporarily or intermittently within these areas. Equipment already in use before July 2003 can continue to be used, provided the risk assessment shows it is safe to do so.

*Electrical equipment to be used in areas classified as hazardous 'zones' should be of the appropriate category (see Table 1). These are defined in Schedule 3 of DSEAR and are as follows:

Zone	Equipment Category	Type of protection (dependant on the risk)
Zone 0:	Category 1	ia
Zone 1:	Category 1 or 2	ia, ib, d, e, p, m, o and q
Zone 2:	Category 1, 2 or 3.	As zones 0, 1 plus 'n'

Table 1: Zones for Hazardous Atmospheres Containing Vapours and Gases

The definitions of zones are as follows:

- Zone 0 A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist in air is present continuously, or for long periods of time, or frequently.
- Zone 1 A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.
- Zone 2 A substances in the form of gas, vapour or mist in air is not likely to occur but, if it does, will be present for a short period only.

- Equipment certified to meet the relevant requirements of the 3 categories should always be marked with the following explosion protection symbol.



- Where possible, electrical equipment should be positioned outside the zoned area, e.g. light switches to paint stores could be located externally.
- All electrical wiring should be installed in accordance with BS7671 Requirements for Electrical Installations (Institute of Electrical Engineers - IEE Wiring Regulations 16th Edition) or the relevant IEE Wiring Regulations.

Ventilation

Removal of flammable vapours is one of the prime means of preventing a fire or explosion. If the concentration is kept well below the flammable limit then a hazardous atmosphere will not occur in normal circumstances.

- Mechanical ventilation should be provided in work areas at low level by means of one or more fans, preferably extracting directly to the open air. Only clean air should be used to replenish air supplied and sufficient inlets should be positioned at high level to provide a cross flow. If exhaust ducting has to be used then it should not pass through any other part of the building, and be as short as possible, without any sharp bends.
- Adequate ventilation should be provided to prevent vapour concentrations above the lower flammable limit. Normal ventilation rates are approximately 60 cubic metres of air per litre of paint or solvent used.
- Where multiple booths are used there should be a separate fan and duct for each booth so as to reduce the possibility of fire spreading from one to the other. Motors should not be located in the ductwork.
- Interlocks should be provided to prevent spraying or operation of coating machines and the like without the extraction fans running. Fans should also be run for a period before and after the process operates.
- Fans and ducts should be accessible for cleaning, with access hatches provided. Cleaning should be conducted regularly using a safe system of work (ideally weekly).

Electrostatic Spraying

Electrostatic spraying introduces additional hazards through the use of high voltage equipment. Whilst proprietary equipment is usually well constructed, a number of other precautions need to be considered.

- Only electrical equipment approved by British Approval Service for Electrical Equipment in Flammable Atmospheres (BASEEFA) should be used (as specified above).
- The high tension cables should be protected against damage and inspected regularly to ensure they are in a good condition.

- All equipment and personnel within 3 metres of the electrodes need to be connected to a common earth. It should not be assumed that a concrete floor will provide a good earth, especially if a build-up of deposit is likely to occur. Anti-static clothing and footwear will also need to be provided.
- Hangers on conveyer systems will need to be cleaned regularly to provide effective earthing of the work piece.
- Special care is necessary when cleaning guns or nozzles. The power needs to be turned off and all cans of solvent need to be connected to earth.
- Regular testing of earthing arrangements to all equipment and plant is important, the resistance not to exceed 1 ohm.
- Airflow interlocks should be provided to isolate power if there is a reduction in the exhaust airflow.

Drying or Stoving

Proprietary plant is usually well designed and constructed, but certain points need to be considered.

- Ovens should be located as far away as practical from sources of vapour such as spray booths or dip tanks. 6 metres should be considered a minimum unless separated by non-combustible partitioning providing a minimum of 30 minutes fire resistance.
- Ovens and flues should be kept well clear of combustible materials, including any in the building structure, such as roof beams.
- The manufacturer's operating instructions should be clearly displayed and observed, particularly with reference to loading capacities, temperatures and ventilation requirements.
- Adequate ventilation must be provided to the compartment in which ovens are located and ventilation grilles or vents should not be obstructed. Explosion venting should be provided.

Paint Storage

- Large stocks should be stored outside in a purpose-built detached store, but if this is not possible then an internal storeroom, providing 2 hours fire resistance and built of brickwork or concrete, may be acceptable.
- Quantities stored inside the premises should be kept to the minimum level practicable. It is recommended that a maximum of 50 litres of highly flammable liquids, or 250 litres of flammable liquid, are kept in the working area at any time, providing it is kept inside an approved metal bin or locker.
- Mixing or dispensing should not be done inside storerooms, but within purpose-built paint kitchens or mixing rooms enclosed by non combustible partitioning. Ventilation and electrical equipment should be in accordance with the recommendations above and all containers should be kept closed when not in use. Where the provision of such facilities is not merited then a well-ventilated booth with forced extraction may be adequate.

Management and Housekeeping

- Even with the best of facilities being provided, the safety precautions can be compromised if good management and operating standards are not observed.
- All processes should be carried out by authorised staff, who have received proper training.
- The best possible standards of cleanliness and housekeeping should be maintained. Quantities of flammable material should be kept to a minimum and all refuse and litter should be placed in metal bins and removed regularly. Unused paint should be returned to storage areas at night.
- The use of approved safety containers for the dispensing, transport and handling of flammable solvents should be encouraged.
- Paint deposits from overspray, drip trays and the like should be cleaned off regularly using non-ferrous metal tools. The use of peelable coatings assists this considerably and is preferred to the use of paper linings. Filters should also be changed regularly as they become less efficient when clogged. The use of water wash booths is preferred to dry back booths.
- Smoking should be strictly prohibited, as should the presence of any form of naked light or flame.
- Maintenance of plant should be done in accordance with the manufacturer's recommendations and all safety devices should be checked regularly. This should be done as part of a planned maintenance programme which could also include provision for cleaning of normally inaccessible areas such as ductwork or the inside of ovens.
- When carrying out alterations or maintenance, instructions should be in place that no work be done involving welding, cutting or the use of such tools as angle grinders which can cause sparks. A hot work procedure needs to be adopted if no alternative method can be used and suitable precautions taken to ensure that no flammable materials or residues are present.

Fire Protection

- Adequate provision should be made for portable extinguishers. A foam or dry powder extinguisher with a fire rating of at least 89B should be provided at every spray or application position, with a minimum of two extinguishers overall. Large facilities with many positions may need to modify this arrangement.
- Large or very important plant should be protected with fixed extinguishing systems, which should be designed to insurers' requirements.
- Where sprinklers are provided, any heads which are likely to become covered with paint deposits, such as within spray booths, should be covered with paper bags which should be changed at least weekly.

Summary

Paint spraying and other painting processes introduce additional fire risks into the workplace which need to be managed and controlled. By following the recommendations in this Risktopic, the risk of a fire starting from a paint spraying process can be reduced. Assessment of the risk is the first step in identifying areas where flammable vapours could be present and it is important to consider the location of equipment which could provide an ignition source. Any electrical equipment within these areas must be safe to use. For example, Zurich Surveyors often find unprotected light switches within paint storage areas. If these cannot be moved outside of the storage area they should be replaced with intrinsically safe switches which comply with the electrical zoning requirements noted in this Risktopic.

Another common issue within spray shops is the build-up of overspray, which remains combustible even when dried off and suitable maintenance or cleaning activities should be undertaken on a regular basis to prevent a build-up of overspray on walls, floors and extraction fans.

Useful References

1. Dangerous Substances and Explosive Atmospheres Regulations 2002.
2. Zurich Risktopic: Highly Flammable Liquids
3. Zurich Risktopic: Static Electricity

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