

Recommendations



for fire safety in
paint spraying
processes
(excluding
automotive
refinishing)

RC32



Fire Protection
Association

InFiReS

LOSS PREVENTION RECOMMENDATIONS

The aim of the FPA series of Recommendations is to provide loss prevention guidance for industrial and commercial premises and systems. The series continues a long tradition of providing authoritative guidance on loss prevention issues started by the Fire Offices' Committee (FOC) of the British insurance industry more than a hundred years ago and builds upon earlier publications from the Loss Prevention Council and the Association of British Insurers.

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Copies of this document may be obtained from the publications department of the FPA, at the above address.

Printed by Alden Press 0.9/07.08

Front cover image © mjl84 - Fotolia.com

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SCOPE

These Recommendations concern the key aspects of property protection in processes involving the spraying of paint and similar surface treatments using powders and flammable or highly flammable liquids, with subsequent stoving and curing. Many of these Recommendations may apply equally to other coating processes such as dipping, roller or flow coating, and fluidised bed coating. Automotive refinishing processes are excluded; these are addressed in RC31 (ref. 1).

Guidance is limited to ways in which the hazards of fire and explosion initiation and spread may be reduced to a minimum. Some liquids, vapours and dusts may be toxic or irritants, when extra precautions to those given in these Recommendations may be necessary (see, for example, ref. 2).

For further information relating to life safety issues and fire safety regulations, the Health and Safety Executive or the local fire authority should be consulted.

SYNOPSIS

These Recommendations provide guidance for those managing and undertaking spraying processes, including powder treatments, in premises other than those where automotive refinishing is carried out. The need for the DSEAR ‘VICES’ acronym to be applied and suitable fire protection measures to be provided are emphasised, together with the importance of an effective fire safety management regime.

DEFINITIONS

Classification of hazardous areas

(BS EN 60079-10: 2003) (ref. 3)

(This classification refers to areas in which open processes are carried out. Areas in which closed processes are undertaken should be subject to a risk assessment.)

Zone 0: An area in which an explosive gas atmosphere is present continuously or for long periods.

Such zones are uncommon, but include the interior of extract ductwork (where there may be gassing off from deposited solids, particularly just after switching off the fan on completion of work).

Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation.

Such zones should include:

- (a) the interior of a spray booth; and
- (b) within 2m horizontally around any source of flammable vapour and vertically upwards from the floor to 1m above the source, over the whole 2m horizontal radius.

In zones where there are many vapour sources, it is recommended that the whole zone from floor level up to 1m above the highest source be designated Zone 1 to allow flexibility in rearranging plant and simplifying

maintenance. This would include paint kitchens/mixing areas and paint shops containing several booths.

Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation. If it does occur, is likely to do so only infrequently and will exist for a short period only.

Such zones include:

- (a) a further horizontal zone extending 2m beyond the Zone 1 above, and from floor level up to the height of the Zone 1 or 3m minimum; and
- (b) store rooms containing sealed tins of paint (any store room containing open tins, or where containers are opened, should be Zone 1).

Zone 20: A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, for long periods or frequently.

Zone 21: A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.

Zone 22: A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Explosive Limits

(BS EN 60079-10: 2003) (ref. 3)

Lower explosive limit (LEL): The concentration of flammable gas or vapour in air, below which the gas atmosphere is not explosive.

Upper explosive limit (UEL): The concentration of flammable gas or vapour in air, above which the gas atmosphere is not explosive.

Fire resistance

In this document, fire resistance refers to the material properties of both insulation and integrity.

Flammable liquid

A liquid (etc) as defined below for highly flammable liquid but with a flashpoint up to 55°C.

Highly flammable liquid

The definition of 'highly flammable liquid' in DSEAR 2002 (ref. 4) is as follows:

'Highly flammable liquid' means any liquid, liquid solution, emulsion or suspension, other than aqueous ammonia, liquefied flammable gas, and liquefied petroleum gas which:

- (a) when tested in accordance with Part A.9 of the Annex to the Directive has a flashpoint of less than 32°C; and
- (b) when tested at 50°C using the procedure referred to in Appendix B to the 'Approved requirements and test methods for the classification and packaging of dangerous goods for carriage' (ref. 5) with a heating time of 60 seconds supports combustion.

INTRODUCTION

The dusts and vapours that are evolved during the spraying process and the flammable nature of the solid residues may present serious fire and explosion hazards. Deposits of material used in the processes may be susceptible to spontaneous heating, particularly if several layers of deposits are allowed to build up over time.

Drying, baking and curing processes often involve the use of heaters and ovens, which present additional fire and explosion hazards.

Flammable liquids fall within the definition of a 'dangerous substance' as defined in the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) (ref. 4). Therefore, if flammable solvents or paints are used, this legislation will apply and a suitable and sufficient assessment of the hazards associated with these materials has to be undertaken.

Where an explosive atmosphere may occur, the workplace must be classified into zones based on the frequency and duration of the explosive atmosphere (see BS EN 60079-10: 2003, ref. 3) and the zones checked by a competent person.

It is a legal requirement for employers to carry out an assessment of the risk from fire to their employees, visitors and other 'relevant persons' in compliance with the Regulatory Reform (Fire Safety) Order 2005 and the equivalent legislation in Scotland and Northern Ireland (refs 6 to 9). As a result, the 'responsible person' for fire safety in the premises for the purposes of the Order must make a suitable and sufficient assessment of the risks to which relevant persons are exposed for the purpose of identifying the general fire precautions to ensure the safety of both employees and non-employees in and about the premises.

The assessment process must be reviewed if it is suspected that it is no longer valid or when changes have been made to the layout of the premises, the processes carried out, the amounts or types of hazardous substances present or the number and character of the people who may be present. The insurers of the business will often be able to offer assistance with this process.

As fire safety legislation is only concerned with life safety issues, it is recommended that when the fire risk assessment process is carried out, consideration must also be given to an assessment of the risks to the building, its contents and the continuing smooth running of business operations.

The fire risk assessment should thus identify plant that is essential to the business but may be unique or difficult to replace. Equipment of high intrinsic value should also be identified. An action plan should be prepared to reduce the risk of damage from fire to such equipment or installations and a suitable contingency plan should be prepared. Further guidance on the preparation of such a plan can be found in *Business resilience. A guide to protecting your business and its people* (ref. 10).

Other legislation may impose additional requirements to the provisions contained within this document (see refs 11 and 12). Due regard should also be given to environmental protection, particularly the disposal of waste solvents and solid residues.

To reduce the fire hazards on the premises, attention should always be given to the possibility of replacing flammable liquids with non-flammable liquids or, at least, with those having a flashpoint above 55°C.

RECOMMENDATIONS

1. General

- 1.1 Wherever potentially hazardous materials are stored or used, a list of the substances present should be maintained, along with details of their quantities and locations, as required in the COSHH Regulations (ref. 12). These details should be readily available for use by the fire brigade.
- 1.2 The HSE guidance in booklet HS (G) 51 (ref. 13) suggests the use of the acronym VICES to help apply five basic principles which ensure that any flammable or highly flammable liquid is used and stored with appropriate care.

The acronym may be explained as follows:

V Ventilation (see section 2)

- Is there sufficient ventilation to keep the concentration of the liquid's vapour below its lower explosive limit?

I Ignition (see section 3)

- Have all possible ignition sources been removed?
- Is the electrical and heating equipment used in this area suited to the risk category?

C Containment (see section 4)

- Are the liquids stored in suitable containers?
- Is only the minimum quantity for the work period kept in the workplace?
- Is explosion relief provided?

E Exchange (see section 5)

- Can flammable substances be eliminated?
- Can the substance be replaced by a less flammable one?

S Separation (see section 6)

- Is the storage of liquids separated from other stored materials?
- Is the area where the liquids are used adequately separated from those used for other purposes?

- Are physical barriers (examples might be walls, doors, cabinets and bins) present as required?

1.3 Suitable staff training should be in place to ensure all personnel are aware of the hazards in the workplace and apply VICES to ensure a safer working environment for all.

1.4 Additional guidance on the application of VICES to the storage and use of flammable liquids is set out in RC20: Parts 1 and 2 (refs 14 and 15)

2. Ventilation

2.1 Flammable vapours and paint overspray should be removed from the process area by means of adequate mechanical ventilation at low level, preferably having free discharge direct to the open air. Only clean air should be used to replenish air supplies and sufficient inlets should be provided at a high level. Inlets should be positioned so as to provide a cross flow.

2.2 Exhaust ducts should not have sharp bends or ledges and should preferably be taken directly to the open air through an external wall or the roof. Any ducts that pass through other parts of buildings should have a minimum fire resistance of 30 minutes, or other appropriate level to maintain the fire integrity of the building compartment.

2.3 The points of discharge of vapours should be sited well clear of both potential ignition sources and entry points to buildings. Controls on dust and vapour emissions may be required by the provisions of various environmental protection legislation (refs 16 to 21).

2.4 There should be a separate ventilation fan and duct for each booth. Motors should not be located within the ductwork.

2.5 Fans and ducts should be accessible for cleaning, with access hatches provided at ductwork bends. Cleaning should be carried out regularly, following an assessment of the build-up of deposits. The deposits will be readily combustible and care is necessary in removal and storage. Non-metallic scrapers should be used. The build-up of deposits in filters has been known to cause fires and thus filters should be regularly cleaned and/or replaced, as appropriate.

Deposits should be collected and disposed of in accordance with environmental regulations. See 'Waste Materials' below (sections 6.12 to 6.16).

2.6 Fans should be started at least two minutes before the process commences and should continue for at least five minutes after the process has ceased.

2.7 If an automatic timer is used, means of immediate shutdown should be provided for emergency use.

- 2.8 An airflow or differential pressure switch which monitors the flow of air should be provided in the inlet or exhaust duct and maintained at the setting determined by the COSHH assessment (see ref. 12). The switch should be interlocked with the electrical supply if the unit is electrically heated, or otherwise with the fuel supply to the burner and to an audible alarm. The interlock should have manual reset facilities.
- 2.9 Adequate ventilation should be provided by mechanical means to prevent concentrations of vapour or dust approaching the lower flammable limit. The degree of ventilation required will depend on the properties of the materials, the quantities used, the location of the work and the type of process in use. The ventilation will normally be designed taking into account the results of the COSHH assessment (see ref. 12). It is normally deemed sufficient if the vapour concentration does not exceed 25% of the lower explosive/flammable limit (LEL).
- 2.10 The use of water-wash or water-backed booths is recommended for removing airborne residues and vapours.
- 2.11 When spraying is performed outside a booth, flammable liquids are exposed during transfer, or coated objects are air dried, sufficient ventilation should be provided to ensure the flammable vapour concentrations do not exceed 25% of the lower explosion limit (LEL) in any part of the room.

3. Ignition

- 3.1 All sources of ignition such as naked flames, hot surfaces and unprotected electrical equipment should be excluded. In particular, welding and other forms of hot work must not be undertaken in or in the immediate vicinity of the spraying facilities.

Heating

- 3.2 The spraying or storage area may be heated by:
 - 3.2.1 A heating system providing ducted warm air or supplying hot water or steam to pipes and radiators. The system should incorporate a heat exchanger, so as to prevent flammable vapours from coming into contact with an ignition source.

Any furnace or heat exchanger should be segregated and located outside the process area, in the open, or in a separate building of brick or concrete construction with a fire-resisting self-closing door to each opening. Combustion products should be exhausted to the open, clear of windows or other openings.

Hot water or steam should circulate at a temperature not exceeding 120°C.

- 3.2.2 Electrical heaters of the low temperature flameproof type, certificated for the use. The temperature of the external surface of such heaters should not exceed 120°C and they should be located where they are unlikely to receive paint deposits from overspray etc.
- 3.2.3 Electric under-floor or ceiling heating with heating elements totally embedded in concrete.

Booth temperatures

- 3.3 Operating temperatures should be controlled by thermostats, interlocked with the heating source, to prevent the temperature rising above the design level.
- 3.4 The possibility of the temperature overshooting the set point should not be ignored. Thus the oven should be equipped with a separate high-temperature limit control, of the non-self-resetting type.
- 3.5 Drying/curing times should be restricted by the use of automatic timing devices.
- 3.6 All combustion units should be fitted with flame failure devices.
- 3.7 Automatic fire safety valves should be fitted to shut off the fuel supply in the event of fire.

Electrical equipment

- 3.8 An assessment of the work areas and storage areas should be carried out, and appropriate 'zones' assigned in accordance with BS 60079-10 (ref. 3). Expert advice may need to be sought for this assessment. Certified explosion-protected electrical apparatus and cabling appropriate for the relevant zones should then be selected.
- 3.9 When flammable liquids or dusts are present, although control measures are taken to minimise their uncontrolled release as far as is reasonably practicable, there will always remain the possibility of an explosive/flammable atmosphere forming. In such 'hazardous areas', all sources of ignition, including those associated with electrical sparks or hot surfaces of electrical apparatus, should be excluded or protected. Hazardous areas are classified into zones as described in the definitions section above.
- 3.10 Should it be necessary to use electrical apparatus (including wiring) in hazardous areas, it is imperative that it is suitably explosion-protected, with the degree of protection selected according to its probability of being exposed to a flammable atmosphere.

Additional advice is contained in *Recommendations for the selection of electrical and non-electrical equipment for use in atmospheres containing flammable and explosive gases or vapours* (ref. 22).

- 3.11 All fixed containers, pipe work, mixers and other equipment should be electrically bonded and earthed.
- 3.12 Flexible leads should be provided to bond portable or mobile containers during mixing, filling or discharging operations when static electricity is likely to be generated.
- 3.13 Portable lights or electrical equipment shall be prohibited, unless it is suitable to operate within the appropriate zone.

Smoking

- 3.14 Smoking must be prohibited inside the premises and in all areas (including external areas) where flammable liquids are used or stored. Appropriate notices should be prominently displayed.
- 3.15 Where a smoking shelter is provided it must be:
 - subject to a specific fire risk assessment;
 - constructed of non-combustible materials;
 - where practicable, sited at least 10m away from any building or structure (20m on a site where a timber framed structure is being erected);
 - provided with suitable metal ashtrays and a separate metal waste bin with a fitted metal lid; and
 - provided with a suitable fire extinguisher.
- 3.16 The immediate area around the shelter and the shelter itself should be kept clear of combustible materials including windblown debris and vegetation.
- 3.17 Raised, slatted floors or decking should not be used and concealed or semi-open spaces should be sealed to ensure combustible debris cannot accumulate beneath the shelter.
- 3.18 The use of combustible curtains, canopies and drapes to protect smokers from the elements must be avoided.
- 3.19 In no circumstances should the shelter be sited near:
 - windows;
 - ventilation intakes or extracts;
 - entrances and exits from the premises;
 - hazardous materials;
 - waste storage containers (such as skips or bins); or
 - beneath a canopy or low slung eaves.

- 3.20 Areas where smoking is allowed but no shelter is provided must be free of combustible materials and be equipped with firefighting equipment, metal ash trays and a separate metal waste bin with a fitted metal lid.
- 3.21 A 'no smoking' policy must be established in outside areas where fire hazards exist. Such areas may include refuse and storage areas containing combustible materials, flammable liquids, gas cylinders, foam plastics, fibreboard and timber. 'NO SMOKING' notices must be displayed prominently in these areas.

Electrostatic spraying and coating process (powder- and solvent-based paints)

- 3.22 Only equipment certified for use in the relevant hazard zone should be used. Electrostatic spraying systems for powder should be in accordance with BS EN 50177: 1996 (ref. 23).
- 3.23 Only the spraygun or electrodes and the cables connected to them should be sited within the spray booth or enclosure, unless specially protected.
- 3.24 High tension cables leading to automatic reciprocating guns should be protected against mechanical damage during operation.
- 3.25 Regular inspection of high voltage lines should be carried out to ensure that they remain in a safe condition.
- 3.26 Airflow interlocks should be provided to cut off the power in the event of cessation or reduction of the exhaust airflow.
- 3.27 All personnel, equipment and structures within a radius of 3m of the charged electrodes of the gun or equipment should be effectively connected to a common earth. This includes the floor, or floor covering which should be of conducting material, the spray booth or enclosure, ventilating ducts and pipe work carrying flammable liquids or powders, and in particular any paint solvent cans in which the gun or head is cleaned after use. Wherever possible, containers of flammable paint should be outside the 3m zone; any within must be of metal and be earthed.
- 3.28 Operators should wear anti-static conducting footwear. The wearing of plastic or rubber soled shoes, or plastic or rubber gloves, should be avoided.
- 3.29 To ensure that earth conductivity is maintained, regular tests should be carried out. Hangers from which items are suspended for spraying, and also conveyor hooks, should be cleaned weekly, particularly where the conveyor passes through a drying or baking oven after leaving the spraying area. The resistance to earth of any metal surfaces in the spraying area should not exceed 1ohm.

- 3.30 When cleaning electrostatic guns and feed lines, the high voltage supply should be switched off, and when dismantling guns for further cleaning or nozzle changes, the air and fluid supplies should also be switched off.
- 3.31 On automatic plant, interlocks should be provided to prevent personnel access when the plant is in operation.
- 3.32 Further guidance is available in the British Coatings Federation *Code of Practice* (ref. 24).

Stoving/curing

- 3.33 Ovens should not be located immediately adjacent to the area used for surface finish application work, unless separated by non-combustible 30-minute fire-resistant partitioning.
- 3.34 Attention should be paid to building construction to ensure that any combustible materials are kept to a minimum and are properly protected against exposure. Combustible materials should be sited no closer than 1m to ovens.
- 3.35 Oven design should incorporate smooth interior surfaces and good interior access to allow easy cleaning. Fittings such as racks, trays and hooks should be non-combustible and readily removable or accessible for easy cleaning.
- 3.36 Oven walls should be insulated to keep the exterior surfaces at modest temperatures. Where this is not possible, guard rails and warning signs should be provided to keep personnel and property clear.
- 3.37 Ovens should be provided with explosion venting, in accordance with Annex D of BS EN 1539: 2000 (ref. 25).
- 3.38 Oven ductwork should be metal, have a clearance from combustible materials of at least 225mm and vent to the open in a safe place.
- 3.39 Service openings should be provided for cleaning access.
- 3.40 Ducts should avoid passing through firebreak floors or walls.
- 3.41 Ducts from separate ovens should not be manifolded together.
- 3.42 Ovens should comply with BS EN 1539: 2000 (ref. 25).
- 3.43 Ovens should have the manufacturer's operating requirements for loading capacity, temperature, ventilation requirement, any restricted solvents and other important details clearly shown on the nameplate.
- 3.44 Ovens should have a remote manually operated fuel cut-off valve, which is easily accessible in an emergency.

- 3.45 Automatic controls should initiate an oven shutdown in the event of flame failure, ventilation fan failure, conveyor and turntable drive failure and excess oven temperature. Restart should only be on a manual reset system.

4. Containment

- 4.1 Only the minimum quantity of paint and other flammable liquids should be present in the mixing room and all containers should be kept closed whenever possible to reduce the amount of evaporation.
- 4.2 Dispensing drums should be fitted with self-closing taps and drip trays or containers. The use of hand-operated pumps is recommended.
- 4.3 The use of water-wash or water-backed booths is recommended for removing airborne residues and vapours.
- 4.4 Explosion relief panels should be at least half the area of the smallest side of the enclosure and vented to a safe area.

5. Exchange

- 5.1 At the outset, attention should always be given to eliminating flammable and highly flammable liquids from the workplace wherever possible. Serious consideration should be given to the need for the use of such liquids in the process and the possibility of replacing them with non-combustible liquids as alternatives – or at least with those having a flashpoint above 55°C.

6. Separation

- 6.1 The process should, wherever possible, be carried out in a separate building away from other workshop areas, or a room or compartment exclusively reserved for such work and separated from the rest of the premises by walls, partitions, doors or ceilings (including glazing) providing at least 30-minutes fire resistance.

Any glazing should be fixed and suitably sealed to confine vapours, mists, residues, dusts and deposits to the spray area.

- 6.2 The spraying enclosure should be of sufficient size wholly to accommodate the articles to be painted, and to provide adequate working space, while at the same time allowing unobstructed access to emergency exits.
- 6.3 Booths shall be provided with means of escape.
- 6.4 All doors to the spraying enclosure should be self-closing, and should be kept closed during the process.
- 6.5 The interior wall surface finish should be smooth. This assists and eases cleaning operations.

Storage

- 6.6 It will normally be necessary for a suitable store to be provided for all liquids, whether they are 'highly flammable' or 'flammable'. They should be kept in accordance with the *Recommendations for fire safety in the storage and use of highly flammable and flammable liquids* series of documents (refs 14 and 15).
- 6.7 The quantity of materials for immediate use should be kept to a minimum and in no case exceed the maximum quantity required for the operation of one shift.
- 6.8 Storage of highly flammable and flammable liquids should be minimised and be subject to a risk assessment in accordance with DSEAR (ref. 4). Stored liquids should be kept inside a suitably marked, approved design safety locker or bin. At the end of the shift or day, any unused full or partially used containers should be returned to the bulk store.
- 6.9 All drums and cans should be kept securely closed when not in use and when empty they should again be closed and removed from the building.

Waste materials

- 6.11 In order to comply with the various environmental regulations (refs 16 to 21), it will usually be necessary to account for all discharges of potentially harmful materials and also to return wastes for suitable treatment. This generally results in a need to store wastes until such time as sufficient volume has been accumulated for economic handling.
- 6.12 Liquid waste materials will usually contain some proportion of highly flammable liquid, and thus the same precautions for waste as for clean materials should be taken, unless it can be positively demonstrated that there is no fire risk from the waste concerned.
- 6.13 Liquid waste materials will often be collected in 205-litre drums. These will need to be stored under the conditions specified in the Recommendations set out in refs 14 and 15.
- 6.14 There can be a significant risk of a build-up of static electricity when pouring flammable liquids into drums. A long-necked metal funnel should be used, to prevent splash filling, and earth bonding between the drum, funnel and the vessel being emptied should be provided.
- 6.15 There is also a significant fire risk from the presence of 'empty' tins and used air extract filters containing large quantities of combustible deposits. All materials such as these should be kept in a suitable store (see refs 14 and 15). Cleaning rags soaked in thinners should be stored in metal receptacles with metal lids.

- 6.16 Contaminated air extract filters may contain large quantities of combustible deposits and present a significant fire risk, particularly if they have been exposed to multi-coating processes in which the combined coatings may be susceptible to chemical reaction or spontaneous heating. Contaminated filters should be removed from the building as soon as they have been replaced, wetted down and kept in a suitable store or in external metal containers with metal lids.

Mixing rooms and distribution systems

- 6.17 The mixing of paints and other surface finishings should be undertaken in a purpose-built mixing room.
- 6.18 Piping that conveys flammable liquids from mixing rooms or similar areas should be:
 - constructed of steel or other material compatible with the hazard;
 - secured in position;
 - subject to a weekly visual inspection; and
 - suitably bonded and earthed.
- 6.19 Piping should not pass through fire compartments, kitchens or ducting.
- 6.20 Shut-off valves linked to raise an alarm should be provided where flexible tubing or hose is used.
- 6.21 The walls, ceiling and floor of a mixing room should be of at least 30-minutes' fire resistance, with a self-closing 30-minute fire-resisting door.
- 6.22 The floor should be sloped or sills be formed across door openings to retain any spilt or leaking liquids.

7. Housekeeping

- 7.1 In view of the flammable nature of solid residues of cellulose solutions, and in particular cellulose nitrate, strict attention should be paid to cleanliness when these are used.
- 7.2 All places in booths where dusts and dry deposits can accumulate should be cleaned at least once a week. Powders and dusts should be removed using a vacuum cleaner, not by brushing.
- 7.3 Cleaning utensils should not be made of aluminium, ferrous metals or other sparking materials. Highly flammable liquids should not be used for cleaning purposes.
- 7.4 To facilitate cleaning, suitable peelable coatings may be used to line the booth. (Polythene sheeting held in place with water or a detergent solution is not suitable for this purpose.)
- 7.5 Scrapings and sweepings from spray deposits should be placed immediately in metal receptacles with metal lids, wetted down and removed from the building at the end of each day.

- 7.6 Any oily waste, disposable overalls and used cleaning cloths should be deposited in metal receptacles with metal lids and also be removed from the building at the end of each day.
- 7.7 Non-combustible absorbent material should be readily available to soak up spillages. After use it should be swept up, put in a metal receptacle with a metal lid and stored outside the building to await disposal in accordance with the supplier's recommendations.
- 7.8 In view of the risk of spontaneous ignition, enclosures used for cellulose finishes should not be used for vegetable oil paint (oil-based synthetics) and varnish processes unless the enclosures and ventilation ducting are thoroughly cleaned in accordance with the manufacturer's recommendations before each changeover.
- 7.9 There are a number of proprietary cleaning units available which provide for the safe, efficient and quick cleaning of sprayguns and nozzles. It is recommended that such a unit be installed and used in accordance with manufacturer's instructions.
- 7.10 Combustible materials should be kept at least 1m away from the outside of the booth.
- 7.11 The roof of the booth should not be used for storage.

8. Maintenance

- 8.1 All equipment should be maintained in good order in accordance with the manufacturer's instructions.
- 8.2 Booths should be maintained on a regular basis, but at least every six months, as determined by an assessment. The maintenance, which should be carried out by a competent engineer, should include testing of the safety controls and inspection of the ducting. When necessary, the ductwork should be thoroughly cleaned throughout its length.
- 8.3 The roof filters should be inspected, cleaned or replaced at the time of the planned maintenance visits.
- 8.4 Extract filters should be replaced monthly.
- 8.5 All maintenance or contractors' work should be carried out under a permit to work system. Special precautions are necessary when work may generate heat or sparks and strict safety procedures must be followed in respect of any work involving plant or equipment containing or used for the handling of hazardous materials. Further information is provided in the FPA publication *Recommendations for hot work* (ref. 26).

9. Fire protection

- 9.1 A suitable number of appropriate portable fire extinguishers – approved and certificated by an

independent, third-party certification body – should be provided in accordance with BS 5306-8 and maintained in accordance with BS 5306-3 (refs 27 and 28).

- 9.2 Consideration should be given to installing a fixed firefighting system, such as sprinklers or suitable gaseous systems. This will be particularly relevant to very hazardous plant or processes that are critical to the wellbeing of the business. When installing a sprinkler system, the guidance set out in BS EN 12845 and the associated Technical Bulletins should be observed (ref. 29).
- 9.3 The design, installation, commissioning and maintenance of fixed fire suppression systems should be undertaken by a company approved and certificated by an independent, third-party certification body
- 9.4 Sprinkler heads, dry powder or gas discharge nozzles and fusible links where installed in process areas should be protected from accumulation of paint spray deposits and consequent clogging by means of paper coverings which should be changed at least weekly.

10. Fire safety management

- 10.1 A suitable and sufficient fire risk assessment of the premises must be undertaken in compliance with the Regulatory Reform (Fire Safety) Order 2005 or equivalent legislation in Scotland and Northern Ireland (refs 6 to 9). An assessment should also be undertaken in compliance with the Dangerous Substance and Explosive Atmospheres Regulations 2002 (DSEAR).
- 10.2 A scheme should be established and monitored for the training and periodic refresher training of people who are using or could be using potentially hazardous materials. The training should include an understanding of: fire hazards, fire safety precautions and action in the event of a fire.

11. Powder coating (electrostatic, cloud chambers and fluidised bed)

- 11.1 Powder coating should only be carried out in a purpose-built non-combustible booth or enclosure, ideally constructed of metal or metal and wired glass (some plastics are now used but should be subject to a specific risk assessment). The booth/enclosure should contain as few ledges or other horizontal surfaces on which powder deposits can accumulate as possible, and be of sufficient size to accommodate the articles being coated.
- 11.2 Airflow rates should be sufficient to ensure that the powder concentration does not exceed 50% of the minimum explosive concentration. Where this is not known, a figure of 10g/m should not be exceeded. For booths, the airflow at the opening should not be less than 0.4m/s.

- 11.3 An airflow switch should be incorporated so that the powder application plant cannot be used without the ventilation systems running.
- 11.4 When small articles are being coated, grilles should be fitted across the air extract inlet, to prevent them being sucked into the ductwork or fan.
- 11.5 Powder handling equipment such as hoppers, feeders, sieves, filters and collectors should preferably be located outside the workroom but must be close enough to minimise the length of ducting necessary.
- 11.6 Ducts should be metal, as short as possible and have no sharp bends or internal obstructions on which powder deposits can accumulate.
- 11.7 Fans and ducts should be accessible for cleaning.
- 11.8 Excess powder or dust should be removed from the spray booth or other enclosure by means of adequate mechanical ventilation to a filter, collector or similar separator, and the cleaned air either re-circulated or exhausted to the open.
- 11.9 To avoid the creation of dust clouds, cleaning should be by industrial vacuum cleaner.
- 11.10 Powder hoppers, filters, sieves and collectors should however be provided with explosion venting; the required vent area depending on the expected intensity of an explosion, the strength of the structure, the type of vent closure and other factors. Explosion vents should vent directly, or via straight metal ducts not exceeding 3m in length, into the open air at a safe place.
- 11.11 The temperature of preheated articles, when entering the coating plant, should be below the ignition temperature of the paint powder. To achieve this, the temperature of the preheating oven should be thermostatically controlled to a lower level and an interlock fitted to cut off the heat supply should the conveyor system stop moving.

	Yes	No	N/A	Action required	Due date	Sign on completion
12.1 General (Section 1)						
12.1.1 Wherever potentially hazardous materials are stored or used, is a list of the substances present maintained, along with details of their quantities and locations, as required in the COSHH Regulations?						
12.1.2 Is suitable staff training in place to ensure all personnel are aware of the hazards in the workplace and apply VICES to ensure a safer working environment for all?						
12.2 Ventilation (Section 2)						
12.2.1 Has adequate mechanical ventilation been provided at low level where necessary, with direct discharge to the open air?						
12.2.2 Are exhaust ducts free of sharp bends or ledges and taken directly to the open air through an external wall or the roof?						
12.2.3 Are the points of discharge of vapours sited well clear of both potential ignition sources and entry points to buildings?						
12.2.4 Is there a separate ventilation fan and duct for each booth, with motors located outside the ductwork?						
12.2.5 Are fans and ducts accessible for cleaning, with access hatches provided at ductwork bends?						
12.2.6 Are fans started at least two minutes before the process commences and left to run for at least five minutes after the process has ceased?						
12.2.7 If an automatic timer is used, are means of immediate shutdown provided for emergency use?						
12.2.8 Is an airflow or differential pressure switch which monitors the flow of air provided in the inlet or exhaust duct and maintained at the setting determined by the COSHH assessment?						
12.2.9 In the case of processes carried out other than in proprietary vehicle finishing units, is adequate ventilation provided by mechanical means to prevent concentrations of vapour or dust approaching the lower flammable limit of the materials in use?						
12.2.10 Are water-wash or water-backed booths used for removing airborne residues and vapours?						

	Yes	No	N/A	Action required	Due date	Sign on completion
12.2.11 When spraying is performed outside a booth, flammable liquids are exposed during transfer or coated objects are air dried, is sufficient ventilation provided to ensure the flammable vapour concentrations do not exceed 25% of the lower explosion limit (LEL) in any part of the room?						
12.3 Ignition (Section 3)						
12.3.1 Are all sources of ignition such as naked flames, hot surfaces and unprotected electrical equipment excluded from the spraying area?						
<i>Heating</i>						
12.3.2 Is the spraying or storage area heated by an acceptable form of equipment? (see sections 3.2.1 to 3.2.3)						
<i>Booth temperatures</i>						
12.3.3 Are the operating temperatures controlled by thermostats, interlocked with the heating source, to prevent the temperature rising above the design level?						
12.3.4 Is the oven equipped with a separate high temperature limit control, of the non-self-resetting type?						
12.3.5 Are drying/curing times restricted by the use of automatic timing devices?						
12.3.6 Are all combustion units fitted with flame failure devices?						
12.3.7 Are automatic fire safety valves fitted to shut off the fuel supply in the event of fire?						
<i>Electrical equipment</i>						
12.3.8 Has an assessment of the work areas and storage areas been carried out, and appropriate hazard 'zones' assigned?						
12.3.9 Are all sources of ignition, including those associated with electrical sparks or hot surfaces of electrical apparatus protected, excluded from hazard zones?						
12.3.10 Is electrical apparatus (including wiring) in hazardous areas suitably explosion-protected, with the degree of protection selected according to its probability of being exposed to a flammable atmosphere?						

	Yes	No	N/A	Action required	Due date	Sign on completion
12.3.11 Are all fixed containers, pipework, mixers and other equipment electrically bonded and earthed?						
12.3.12 Are flexible leads provided to bond portable or mobile containers during mixing, filling or discharging operations when static electricity is likely to be generated?						
12.3.13 Are portable lights or electrical equipment prohibited, unless it is suitable to operate within the appropriate zone?						
Smoking						
12.3.14 Is smoking prohibited inside the premises and in external areas where flammable liquids are used or stored, with appropriate signs displayed?						
12.3.15 If a smoking shelter has been provided has it been: <ul style="list-style-type: none"> • subject to a specific fire risk assessment; • constructed of non-combustible materials; • where practicable, sited at least 10m away from any building or structure (20m on a site where a timber framed structure is being erected); • provided with suitable metal ashtrays and a separate metal waste bin with a fitted metal lid; and • provided with a suitable fire extinguisher? 						
12.3.16 Is the immediate area around the shelter and the shelter itself kept clear of combustible materials including windblown debris and vegetation?						
12.3.17 Is there an absence of raised, slatted floors or decking with any concealed or semi-open spaces sealed to ensure combustible debris cannot accumulate beneath the shelter?						
12.3.18 Has the use of combustible curtains, canopies and drapes to protect smokers from the elements been avoided?						
12.3.19 Is the shelter sited away from: <ul style="list-style-type: none"> • windows; • ventilation intakes or extracts; • entrances and exits from the premises; • hazardous materials; • waste storage containers (such as skips or bins); • a canopy or low slung eaves? 						

	Yes	No	N/A	Action required	Due date	Sign on completion
12.3.20				Are areas where smoking is allowed but no shelter is provided free of combustible materials and equipped with firefighting equipment, metal ashtrays and a separate metal waste bin with a fitted metal lid?		
12.3.21				Is a 'no smoking' policy established in outside areas where fire hazards exist with 'NO SMOKING' notices displayed prominently?		
<i>Electrostatic spraying and coating process</i>						
12.3.22				Is only equipment certified for use in the relevant hazard zone used?		
12.2.23				Are electrostatic spraying systems for powder in accordance with BS EN 50177: 2006?		
12.3.24				Are only the spraygun or electrodes and the cables connected to them sited within the spray booth or enclosure, unless specially protected?		
12.3.25				Are high tension cables leading to automatic reciprocating guns protected against mechanical damage during operation?		
12.3.26				Are regular inspections of high voltage lines carried out to ensure that they remain in a safe condition?		
12.3.27				Are airflow interlocks provided to cut off the power in the event of cessation or reduction of the exhaust airflow?		
12.3.28				Are all personnel, equipment and structures within a radius of 3m of the charged electrodes of the gun or equipment effectively connected to a common earth?		
12.3.29				Do operators wear anti-static conducting footwear and is the wearing of plastic or rubber soled shoes, or plastic or rubber gloves avoided?		
12.3.30				Are regular tests carried out to ensure that earth conductivity is maintained? Are hangers from which items are suspended for spraying, and also conveyor hooks, cleaned weekly, particularly where the conveyor passes through a drying or baking oven after leaving the spraying area?		
12.3.31				When cleaning electrostatic guns and feed lines, is the high voltage supply switched off, and when dismantling guns for further cleaning or nozzle changes, are the air and fluid supplies also switched off?		

	Yes	No	N/A	Action required	Due date	Sign on completion
12.3.32 Are interlocks provided on automatic plant to prevent personnel access when the plant is in operation?						
<i>Stoving/Curing</i>						
12.3.33 Are ovens located away from areas immediately adjacent to the area used for surface finish application work, unless separated by non-combustible 30-minute fire resistant partitioning?						
12.3.34 Has attention been paid to building construction to ensure that any combustible materials are kept to a minimum and are properly protected against exposure?						
12.3.35 Does oven design incorporate smooth interior surfaces and good interior access to allow easy cleaning, and are fittings – such as racks, trays and hooks – non-combustible and readily removable or accessible for easy cleaning?						
12.3.36 Are oven walls insulated to keep the exterior surfaces at modest temperatures? (Where this is not possible, are guard rails and warning signs provided to keep personnel and property clear?)						
12.3.37 Are ovens provided with explosion venting, in accordance with Annex D of BS EN 1539: 2000?						
12.3.38 Is oven ductwork metal, with a clearance from combustible materials of at least 225mm and vents to the open in a safe place?						
12.3.39 Are service openings provided for cleaning access?						
12.3.40 Do ducts avoid passing through firebreak floors or walls?						
12.3.41 Do ducts which are from separate ovens remain independent throughout their length?						
12.3.42 Do ovens comply with BS EN 1539: 2000?						
12.3.43 Do ovens have the manufacturer's operating requirements for loading capacity, temperature, ventilation requirement, any restricted solvents and other important details clearly shown on the nameplate?						
12.3.44 Do ovens have a remote manually operated fuel cut-off valve, which is easily accessible in an emergency?						

	Yes	No	N/A	Action required	Due date	Sign on completion
12.3.45 Do automatic controls initiate an oven shutdown in the event of flame failure, ventilation fan failure, conveyor and turntable drive failure and excess oven temperature? Is restart only on a manual reset system?						
12.4 Containment (Section 4)						
12.4.1 Is only the minimum quantity of paint and other flammable liquids present in the mixing room, with all containers kept closed whenever possible to reduce the amount of evaporation?						
12.4.2 Are dispensing drums fitted with self-closing taps and drip trays or containers?						
12.4.3 Are explosion relief panels at least half the area of the smallest side of the enclosure, and do they vent to a safe area?						
12.5 Exchange (Section 5)						
12.5.1 Is attention always given to eliminating flammable and highly flammable liquids from the workplace wherever possible?						
12.6 Separation (Section 6)						
12.6.1 Is the process carried out in a separate building away from other workshop areas, or a room or compartment exclusively reserved for such work and separated from the rest of the premises by walls, partitions, doors or ceilings (including glazing) providing at least 30-minutes fire resistance?						
12.6.2 Is the spraying enclosure of sufficient size wholly to accommodate the articles to be painted and to provide adequate working space, while at the same time allowing unobstructed access to emergency exits?						
12.6.3 Are booths provided with means of escape?						
12.6.4 Are all doors to the spraying enclosure self-closing, and kept closed during the process?						
12.6.5 Is the interior wall surface finish smooth to assist and ease cleaning operations?						
Storage						
12.6.6 Is the storage of paints and solvents made the subject of a fire risk assessment?						

	Yes	No	N/A	Action required	Due date	Sign on completion
12.6.7 Is a suitable store provided for all liquids, whether they are 'highly flammable' or 'flammable'?						
12.6.8 Is the quantity of materials for immediate use kept to a minimum and in no case allowed to exceed the maximum quantity required for the operation of one shift?						
12.6.9 Is the storage of highly flammable liquids minimised and subject to a risk assessment in accordance with DSEAR?						
12.6.10 Are all drums and cans kept securely closed when not in use and, when empty, kept closed and removed from the building?						
<i>Waste materials</i>						
12.6.11 Are the drums used to store liquid waste materials kept under the conditions specified in the appropriate regulations (refs 20 to 25)?						
12.6.12 Is a long-necked metal funnel used to prevent splash filling, and are there provisions for bonding and earthing the drums, funnels and vessels being emptied?						
12.6.13 Are materials such as 'empty' tins and used air extract filters containing large quantities of combustible deposits kept safely in a suitable store?						
<i>Mixing rooms and distribution systems</i>						
12.6.14 Is the mixing of paints and other surface finishings undertaken in a purpose-built mixing room?						
12.6.15 Is piping that conveys flammable liquids from mixing rooms or similar areas constructed of steel or other material compatible with the hazard, secured in position subject to a weekly visual inspection, and suitably bonded and earthed?						
12.6.16 Is piping routed so as not to pass through fire compartments, kitchens or ducting?						
12.6.17 Are shut-off valves linked to raise an alarm provided where flexible tubing or hose is used?						
12.6.18 Are the walls, ceiling and floor of a mixing room of at least 30-minutes' fire resistance, with a self-closing 30-minute fire-resisting door?						
12.6.19 Is the floor sloped or have sills been formed across door openings to retain any spilt or leaking liquids?						

	Yes	No	N/A	Action required	Due date	Sign on completion
12.7 Housekeeping (Section 7)						
12.7.1 In view of the flammable nature of solid residues of cellulose solutions and in particular cellulose nitrate, is strict attention paid to cleanliness when these are used?						
12.7.2 Are all places in booths where dusts and dry deposits can accumulate cleaned at least once a week?						
12.7.3 Are cleaning utensils made of materials other than aluminium, ferrous metals or other sparking materials?						
12.7.4 To facilitate cleaning, are suitable peelable coatings used to line the booth?						
12.7.5 Are scrapings and sweepings from spray deposits placed immediately in metal receptacles with metal lids, wetted down and removed from the building at the end of each day?						
12.7.6 Are any oily waste, disposable overalls and used cleaning cloths deposited in metal receptacles with metal lids and also removed from the building at the end of each day?						
12.7.7 Is a non-combustible absorbent material readily available to soak up spillages?						
12.7.8 Is the use of vegetable oil paint (oil-based synthetics) and varnish processes avoided in enclosures normally used for cellulose finishes?						
12.7.9 Are proprietary cleaning units used which provide for the safe, efficient and quick cleaning of sprayguns and nozzles?						
12.7.10 Are combustible materials kept at least 1m away from the outside of the booth?						
12.7.11 Is the roof of the spray booth free from storage?						
12.8 Maintenance (Section 8)						
12.8.1 Is all equipment maintained in good order in accordance with the manufacturers' instructions?						
12.8.2 Are booths maintained on a regular basis, but at least every six months, as determined by an assessment?						
12.8.3 Are the roof filters inspected, cleaned or replaced at the time of the planned maintenance visits?						

	Yes	No	N/A	Action required	Due date	Sign on completion
12.8.4 Are extract filters replaced monthly?						
12.8.5 Is all maintenance or contractors' work carried out under a permit to work system?						
12.9 Fire protection (Section 9)						
12.9.1 Where hazardous materials are used or stored, are a suitable number of appropriate portable fire extinguishers provided, approved and certificated by an independent, third-party certification body?						
12.9.2 Has consideration been given to installing a fixed firefighting system, such as sprinklers or suitable gaseous systems?						
12.9.3 Is the design, installation, commissioning and maintenance of fixed fire suppression systems undertaken by a company approved and certificated by an independent third-party certification body?						
12.9.4 Where sprinkler heads, dry powder or gas discharge nozzles and fusible links are installed in process areas, are they protected from accumulation of paint spray deposits and consequent clogging by means of paper coverings which are changed at least weekly?						
12.10 Fire safety management (Section 10)						
12.10.1 Has a suitable and sufficient fire risk assessment of the premises been undertaken in compliance with the Regulatory Reform (Fire Safety) Order 2005 or equivalent legislation in Scotland and Northern Ireland?						
12.10.2 Has an assessment been undertaken in compliance with the Dangerous Substance and Explosive Atmospheres Regulations 2002 (DSEAR)?						
12.10.3 Has a scheme been established and monitored for the training and periodic refresher training of people who are using, or could be using, potentially hazardous materials?						
12.11 Powder coating (Section 11)						
12.11.1 Is powder coating only carried out in a purpose-built non-combustible booth or enclosure, ideally constructed of metal or metal and wired glass?						
12.11.2 Does the booth/enclosure contain as few ledges or other horizontal surfaces as possible, on which powder deposits can accumulate?						

	Yes	No	N/A	Action required	Due date	Sign on completion
12.11.3 Are airflow rates sufficient to ensure that the powder concentration does not exceed 50% of the minimum explosive concentration? (Where this is not known, a figure of 10g/m should not be exceeded.)						
12.11.4 Is an airflow switch incorporated so that the powder application plant cannot be used without the ventilation systems running?						
12.11.5 When small articles are being coated, are grilles fitted across the air extract inlet, to prevent them being sucked into the ductwork or fan?						
12.11.6 Is powder handling equipment – such as hoppers, feeders, sieves, filters and collectors – located outside the workroom but close enough to minimise the length of ducting necessary?						
12.11.7 Are ducts metal, as short as possible with no sharp bends or internal obstructions on which powder deposits can accumulate?						
12.11.8 Are fans and ducts accessible for cleaning?						
12.11.9 Is excess powder or dust removed from the spray booth or other enclosure by means of adequate mechanical ventilation to a filter, collector or similar separator, and the cleaned air either re-circulated or exhausted to the open?						
12.11.10 To avoid the creation of dust clouds, is cleaning by industrial vacuum cleaner?						
12.11.11 Are powder hoppers, filters, sieves and collectors provided with suitable explosion venting?						
12.11.12 Is the temperature of preheated articles, when entering the coating plant, below the ignition temperature of the paint powder? Is the temperature of the preheating oven thermostatically controlled to a lower level and an interlock fitted to cut off the heat supply should the conveyor system stop moving?						

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RC32

for fire safety in
paint spraying
processes
(excluding
automotive
refinishing)

Recommendations



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Association

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