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## EUROPEAN RESIN MANUFACTURERS ASSOCIATION BOOKLET: GUIDELINES FOR SAFE MANUFACTURE OF RESINS WITH PARTICULAR REFERENCE TO FIRE AND EXPLOSION

BY J C ETCHELLS

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### INTRODUCTION

This DIN introduces guidelines produced by the European Resin Manufacturers Association ([Reference 1](#)) in consultation with HSE and explains their background and development. The DIN is an update of DIN 5003, originally produced in 1996.

### BACKGROUND

Each year there have been a number of fires/explosions in resin reactors. These frequently occur when the vessels are opened during operation for addition of reactants. The most frequent causes have been attributed to ignition of flammable vapours either by:

- Discharge of static electricity, particularly from unearthed operators; and
- Auto-ignition, often at temperatures well below the published auto-ignition temperatures of the materials.

As a result, an industry/HSE Steering Group was set up, its main aim being to provide guidance on prevention and control. The SG was chaired by TD and also had representation from FOD and HSL. Although many of the precautions were known, discussions centered around 2 main issues. These were:

- It had been known for some time that the auto-ignition temperature (AIT) of flammable liquids is dependent upon conditions. In particular it falls with increasing vessel size. The industry were keen to see if it was possible to predict a safe temperature below which auto-ignition would not occur.
- One of the main methods of preventing electro-static charge build-up on a person is for the operator to wear anti-static footwear. However, the industry believed that solvents could have a detrimental effect on such footwear. They

were not keen to recommend them. **(This is now a legal requirement of the DSEAR regulations, which requires appropriate anti static clothing in hazardous areas.)**

Two research projects were commissioned at HSL to investigate these issues and the results have been incorporated into the guidelines.

## RESULTS OF RESEARCH

This confirmed that AITs fall with increasing vessel size and that actual AITs are considerably below published values. However, experimental results were only obtained for pure solvents and the theory developed could not be used to predict the AIT of complex mixtures found in resin kettles. Further information is given in [reference 2](#).

Anti-static footwear retains its properties when used in a resin plant environment, and withstands solvents adequately. The investigation showed that there were no good reasons for operators not wearing anti-static footwear. Further information is given in [reference 3](#).

## GUIDANCE

As a result of the research, guidance on preventing auto-ignitions and electro-static ignitions has been agreed and this is given in para 6.4 and Annex 3 of the guidelines respectively. In particular, the following precautions should be taken during charging:

- Liquid additions should be made through an enclosed system;
- For powder additions, one or more of the following precautions will be reasonably practicable:
  - i) Use of remotely enclosed systems for making additions to reactors.
  - ii) Inerting the reactor atmosphere, the addition point for inert gas being above the resin (see also [\(iv\)](#) below).
  - iii) If (i) and (ii) are not reasonably practicable, then additions to the reactor or visual inspection of the resin should be at a suitable low temperature, well below the AIT. Present data relating to suitable reductions in temperature is unreliable. In theory, temperature reductions may need to be in excess of 200°C, although this is unlikely to be practicable in many cases. Unless the manufacturer can demonstrate unequivocally that ignition will not occur during manual additions or opening for visual inspection then suitable protective screening and clothing should be provided to afford additional operator protection.
  - iv) If the system cannot be fully enclosed, the opening should be reduced to a minimum, for example, by reducing the size of the orifice with an adaptor plate and local exhaust ventilation should be provided to prevent flammable or harmful products entering the workroom. Such controls should be designed to prevent or adequately control the exposure of work people to substances

hazardous to health which may escape when the vessel is opened. Electric motors for fans should not be situated in the path of flammable vapours (this includes the ducts, where even flameproof motors are unsuitable). This may be achieved by using bifurcated, centrifugal or belt-driven axial fans. It should be ensured that the LEV does not draw air into the resin vessel.

- Precautions should be taken against generation of static electricity. Guidance is given in BS 5958: Code of Practice for the Control of Undesirable Static Electricity: Part 2: 1983: Recommendations for Particular Industrial Situations. Operators should be provided with anti-static footwear which complies with BS 5145: Specification for Lined Vulcanised Rubber Boots, and BS 7193: Specification for Lined Lightweight Rubber Overshoes and Overboots.

The guidelines also give guidance on prevention and control of their ignition sources and exothermic runaway. Information on emergency procedures, fire precautions and safe use of materials during processing, handling and storage is also given. Some information on the control of substances hazardous to health is provided although this is mainly outside the scope of the document.

Complimentary copies were sent to each SG and the Chemicals NIG.

## **REFERENCES**

1. Guidelines for Safe Manufacture of Resins with Particular Reference to Fire and Explosion, European Resin Manufacturers Association, 1995, ISBN 0903809 17 6
2. Auto-ignition, Slow Combustion and the Variation of Minimum Ignition temperature with Vessel Size, Snee, T. J., Loss Prevention Bulletin 081.
3. The Use of Anti-Static Footwear in the Resin Manufacturing Industry, RLSD Report No IR/L/EH/85/2, Tolson P.