Safe use of electric kilns in craft and education

Ceramics Information Sheet No 3

Introduction

This information sheet is one of a series produced by the Health and Safety Executive (HSE) in consultation with the Ceramics, Heavy Clay, Refractories and Glass Manufacturing Industries Joint Health and Safety Advisory Committee (CHARGE), the Schools Education Advisory Committee (SEAC) and the Higher and Further Education Advisory Committee (HIFEAC). It is intended to give advice on the safe use of electric kilns for the craft and education sectors.

This guidance has been produced to support the Ceramics Pledge, the Ceramics Industry's initiative in response to the Revitalising Health and Safety agenda and will be useful to managers, supervisors, safety representatives and employees in the ceramics manufacturing industry and those who manufacture, supply and maintain kilns

Legal requirements

The key pieces of legislation covering the manufacture and supply of kilns are:

- The Electrical Equipment (Safety) Regulations 1994. These apply to electrical equipment operating at 75v to 1500v DC and 50V to 1000V AC. They require that the equipment is safe when it is supplied new, bears a 'CE' mark and that the manufacturer/authorised representative produces a written declaration of conformity.
- The Health and Safety at Work etc Act 1974, section 6 (general duties on manufacturers and suppliers to ensure products are safe, and adequate information is provided with respect to their use).
- The Supply of Machinery (Safety) Regulations 1992, amended 1994, do not apply to kilns. They may be relevant to ancillary equipment supplied with a kiln but this would not usually be the case with small kilns.

Requirements that apply to users are contained in:

- The Management of Health and Safety at Work Regulations 1999 (include duties of employers and self-employed people to assess and eliminate or control risks).
- The Control of Substances Hazardous to Health Regulations (COSHH) 2002 (include duties of employers and self-employed people to assess and prevent/adequately control exposure to hazardous substances).
- The Provision and use of Work Equipment Regulations 1998 (include duties of employers and self-employed people to provide and maintain safe equipment and train workers).
- The Electricity at Work Regulations 1989 (include duties of employers to ensure electrical equipment is safe and safe systems of work are adopted for maintenance etc).

Hazards

The hazards from electric kilns include electric shock, burns and fire. By ensuring that kilns are correctly designed, properly installed, located, operated and maintained, these hazards will be adequately controlled. Other hazards include:

- refractory ceramic fibre (RCF) linings (including asbestos in older kilns);
- fumes which can be given off during some firing cycles; and
- manual handling problems associated with the loading and unloading of ware.

Installation and location of the kiln

Many of the fires involving ceramic kilns occur at night, due to overheating of wood forming part of the construction of roofs, ceilings or floors above the kiln.

Kilns should be located away from general work areas and preferably be sited in a separate room or area. They should be situated on a loadbearing floor and there should be adequate clearance between the kiln and the ceiling. If there is any doubt as to the adequacy of the strength of the flooring where a kiln is to be sited, advice should be sought from a structural specialist (eg a structural engineer).

Where there is limited headroom above an electric kiln other fire precautionary measures should be taken such as the use of a heat shield or the installation of a metal canopy hood and flue to extract the heat to atmosphere. The canopy may require insulation and should extend well over the kiln door. If the flue has to pass through or near combustible materials proper measures should be taken to avoid the risk of fire. The installation of flues should only be carried out by a properly trained competent person with a specialist knowledge of flue installations.

The floor, ceiling and walls adjacent to the kiln should all be made of, or covered with, a non-combustible material.

Sufficient clearance should be left around the kiln to allow access for maintenance, servicing and free movement of air. All kilns that are not permanently wired should be positioned so that they can be plugged directly into an adequately rated and protected socket without the use of an extension cable (See 'Electrical safety' section for further details).

Good housekeeping around kilns is essential and combustible materials should never be stored near the kiln or allowed to accumulate around it.

The metal casing of the kiln can become very hot (up to 160°C in some cases) despite mineral insulation. Care should be taken, particularly where children, members of the public or potentially vulnerable people (such as those with learning difficulties or physical disabilities) are undergoing instruction or are able to gain access to the kiln. In these cases, a barrier or kiln cage should be used. Safeguards should be in place to prevent people becoming trapped inside the barrier or kiln cage and the operating controls should be located outside the barrier or kiln cage and positioned so that the kiln door does not obstruct access to them when open.

Electrical safety

Prior to installing an electric kiln, the electrical system of the premises should be assessed and tested by a competent electrician to ensure it is safe and can accommodate the power rating required for the kiln. If this is not the case, a new supply system suitable for that use should be installed.

The main requirements to ensure electrical safety of a kiln are:

- an electrical supply of adequate current rating;
- an easily accessible and clearly labelled adequate means of isolation from the electrical supply;
- protection against excess current by suitably rated circuit breakers or fuses;
- connection of the kiln to the supply switch disconnector should be suitable for the environment (a cable with heat resisting insulation) and be protected against mechanical damage (see BS7671:2001 (as amended));
- accessible external metalwork should be adequately and effectively earthed (see BS7671:2001 (as amended));
- no access to live heating elements should be possible. This is usually achieved by interlocking the kiln door with the power supply, normally by means of a positively operated interlocking device(s) in combination with a kiln supply disconnecting device (refer to BS PD 5304:2000 and BS EN 1088:1996 for guidance);
- any electrical work on the kiln and supply system should be carried out by a properly trained competent person (eg an electrician) and switchgear control panels should be secured to prevent unauthorised access;
- no 'live' working should be carried out on the kiln or electrical system except for essential work which cannot be done when the system is dead eg diagnostic testing. Where such 'live' working has to be carried out, it should be done in accordance with regulation 14 of the Electricity at Work Regulations 1989 and be carried out by an authorised trained competent person using appropriate equipment as detailed in HSE guidance note GS 38 *Electrical test equipment for use by electricians*;
- kiln control panel doors and covers should be kept secured in position, eg with locks, bolts or allen screws (clips and wing nuts are not acceptable) while the kiln is in use. If control panel doors or covers are removed to allow maintenance work they should be replaced after the work is completed and before the power is switched on;
- the kiln and its electrical system should be maintained in a safe and efficient condition (see section on 'Kiln maintenance');
- extension leads and multi-way plugs should not be used to connect a kiln to the supply.

Safe operation

Electric kilns should only be used by trained operators who are familiar with safe working procedures (including proper use of controls and safety devices) and are capable of recognising faults and coping with emergencies.

With respect to educational establishments, students should only be allowed to use the kiln under the strict supervision of a competent operator.

Where practicable, two or more people should be capable of operating the kiln and be familiar with the emergency procedures, in order to ensure that there is sufficient cover in the absence of the normal operator.

Written instructions outlining the safe operation and emergency procedures for the kiln should be clearly displayed in a prominent position next to it, together with a list of those people responsible for the kiln.

Safe systems of work should be adopted at all times when the kiln is in use. Gloves providing suitable thermal protection to EN 407 and protective eye wear should be worn when removing ware while the kiln is still warm. In addition, protective eye wear to EN 166, fitted with filters conforming to EN 171 should be used when removing spy hole plugs to inspect cones when the kiln is hot.

Kiln maintenance

The electrical installation and the kiln should be regularly maintained. This includes regular inspection, particularly where sockets and flexible cables are used. Both the electrical installation and the kiln should be periodically tested to ensure that the bonding, earthing, insulation,

connections, and electrical protection will operate for faults on the installation and the kiln. If faults are found, the kiln and installation should be taken out of service until the faults can be corrected.

Any work carried out on the kiln or its electrical system should be done by a competent person and usually one who is familiar with this type of equipment.

The door safety interlock should be regularly inspected and tested and should conform with the principles set out in BS PD 5304:2000, BS EN 292 and BS EN 1088.

Adequate technical information about the kiln should be available to enable proper maintenance to be carried out.

It is advisable to keep an up-to-date record of the nature and extent of all maintenance and repair work carried out on the kiln, including any servicing documentation.

Refractory ceramic fibre (RCF) linings

Many modern kilns have refractory ceramic fibre (RCF) as part of their construction. Under the Chemicals (Hazard Information and Packaging for Supply) Regulations 2002 (known as CHIP 2002), RCF is classified as a category 2 carcinogen. This means they are ‘substances to be regarded as if they are carcinogenic to humans’.

Under normal circumstances the risk presented by the presence of RCF in the kiln is unlikely to be significant. Activities that could disturb or damage the RCF, such as relining or lining repair, are likely to cause the release of fibres and suitable precautions to prevent the inhalation of fibres and contact with the skin should be taken. Personal protective equipment (PPE), including suitable respiratory protective equipment (RPE), that protect the wearer from inhaling toxic dust particles, should be worn when these operations are carried out.

An additional problem associated with RCF is that after being exposed to high temperatures (greater than 1000 °C) for prolonged periods, which happens in kilns, the RCF at the surface of the lining may devitrify to crystalline phases including cristobalite, a form of crystalline silica that can cause silicosis.

Further information on the precautions to be taken when handling or working with RCF is available from HSE and others (see the ‘Further reading’ section).

Older kilns may be thermally insulated with asbestos materials. Work should not be undertaken which would expose or disturb asbestos. Specialist advice should be obtained if any work is planned on a kiln which would expose or disturb asbestos, or if it is encountered accidentally. HSE can advise on the names of licensed asbestos contractors.

Fumes

General ventilation or ‘dilution’ ventilation of the workplace is required to provide a minimum standard of fresh air to help maintain a healthy working environment. It does this by diluting hazardous fumes, which may be given off during some firing cycles, and by helping to control workroom air temperature. A good level of ventilation can be achieved either naturally, eg through doors, windows etc, or mechanically using a fan to supply/extract air. It should be noted that natural ventilation relies on wind pressure and temperature differences and is therefore susceptible to changes in outdoor conditions, whereas mechanical ventilation is controllable.

In many circumstances the fumes given off during the firing process may not be adequately controlled using general ventilation and local exhaust ventilation may need to be considered. An example of this is an extract canopy hood positioned above the kiln to remove fumes and heat to the outside. The necessity for this should be considered as part of the assessment of risks to health required by the Control of Substances Hazardous to Health Regulations (COSHH). With both mechanical ventilation and local exhaust ventilation, care should be taken to ensure that there is sufficient replacement or ‘make-up’ air for the ventilation to operate correctly, eg louvres or grilles in doors.

Manual handling

The Manual Handling Regulations 1992 require that tasks involving manual handling be assessed and measures taken to reduce the risks created by them. Depending on the nature of the ware being fired, loading and unloading the kiln may present a hazard. You need to consider loads being handled during these operations as well as the amount of twisting and turning that has to be done by the operator. Where reasonably practicable, trolleys or other devices should be used to transport ware around the premises and heavy loads lifted using suitable lifting aids. All employees involved in the manual handling of heavy articles should receive adequate training.

Further reading

Safe operation of ceramic kilns HSE Books 1993 ISBN 0 7176 0630 9

BS EN 746 *Industrial Thermoprocessing Equipment. Part 1: Common safety requirements* British Standards Institution

The Electrical Equipment (Safety) Regulations 1994 SI 1994 No 3260 The Stationery Office

BS EN 7671: 1992 (as amended) *Requirements for electrical installations* British Standards Institution

BS EN 60204-1: 1997 *Safety of machinery. Electrical equipment of machines. Part 1: General requirements* British Standards Institution

BS EN 1088: 1996 *Safety of machinery. Interlocking devices associated with guards, principles for design and selection* British Standards Institution

BS EN 954: 1997 *Safety of machinery. Safety related parts of control systems. Part 1: General principles for design* British Standards Institution

EN 166: 1995 *Personal eye protection – specifications* British Standards Institution

EN 171: 1992 *Specification for infra-red filters used in personal eye protection equipment* British Standards Institution

Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance L22 (Second edition) HSE Books 1998 ISBN 0 7176 1626 6

Management of health and safety at work. Management of Health and Safety at Work Regulations 1999. Approved Code of Practice and guidance L21 (Second edition) HSE Books 2000 ISBN 0 7176 2488 9

Manual handling. Manual Handling Operations Regulations 1992. Guidance on Regulations L23 (Second edition) HSE Books 1998 ISBN 0 7176 2415 3

The Supply of Machinery (Safety) Regulations 1992 SI 1992/3073 The Stationery Office 1992 ISBN 0 11 025719 7 as amended by *The Supply of Machinery (Safety) (Amendment) Regulations 1994* SI 1994/2063 ISBN 0 11 045063 9

The Health and Safety at Work etc Act 1974 The Stationery Office 1974 ISBN 0 10 543774 3

Memorandum of guidance on the Electricity at Work Regulations 1989 HSE Books 1989 ISBN 0 7176 1602 9

COSHH essentials: Easy steps to control chemicals HSG193 HSE Books 1999 ISBN 0 7176 2421 8

Hazards from the use of refractory ceramic fibre Information document ID 267/3 available free from www.hse.gov.uk

The Buildings Regulations 2000 (Part J Heat-producing appliances) SI 2000/2531 The Stationery Office 2000 ISBN 0 11 099897 9

Recognition and control of exposure to refractory ceramic fibres (RCF) European Ceramic Fibre Industry Association (ECFIA), 3 rue du Colonel Moll, 75017 Paris, France

Working safely with man-made vitreous fibres: Practical guidance for managers and operators British Ceramic Confederation, Federation House, Station Road, Stoke on Trent ST4 2SA

Further information

British Standards are available from BSI Customer Services, 389 Chiswick High Road, London W4 4AL Tel: 020 8996 9001 Fax: 020 8996 7001 Website: www.bsi-global.com

The Stationery Office (formerly HMSO) publications are available from The Publications Centre, PO Box 276, London SW8 5DT Tel: 0870 600 5522 Fax: 0870 600 5533 Website: www.tso.co.uk (They are also available from bookshops.)

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA Tel: 01787 881165 Fax: 01787 313995 Website: www.hsebooks.co.uk (HSE priced publications are also available from bookshops and free leaflets can be downloaded from HSE's website: www.hse.gov.uk.)

For information about health and safety ring HSE's Infoline Tel: 08701 545500 Fax: 02920 859260 e-mail: hseinformationservices@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG.

This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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