

# Risk Control

Fixed heating equipment burning waste fuel



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## ➤ SCOPE

This document provides guidance for both insurance surveyors and end-users to assist them in reducing property damage and business interruption from incidents involving the burning of waste fuel for heating purposes.

This guidance does not relate to the burning of gaseous wastes in combined heat and power (CHP) units or similar equipment or to incinerators used for the disposal of solid waste materials. The recommendations also do not apply to portable or transportable heaters, for which reference should be made to RC15: **Recommendations for the use of portable and transportable heaters in commercial and industrial premises** (ref. 1).

The production of biodiesel fuel from what would otherwise be sources of waste oil, such as cooking oil, is also the subject of another publication, RC46: **Fire safety in the manufacture of biodiesel fuel** (ref. 2).

## ➤ SYNOPSIS

These recommendations concern equipment that utilise sources of fuel that would otherwise be wasted. Guidance is presented for oil fired heaters, wood burning stoves and similar devices and their associated flues. Recommendations are also presented to ensure the effective fire safety management of the equipment and minimisation of the associated hazards in the premises in which it is located.

## ➤ HAZARDS

All forms of heating can be regarded as potential hazards from a fire perspective. However, suitably managed and with the use of correct equipment, the use of waste fuel can be an acceptable method of providing heating and cooking in many locations.

The use of heaters using waste fuel is increasing, both due to rising fuel costs and for environmental reasons, but heaters using waste fuels may constitute a higher fire hazard than those burning conventional fuels.

Common hazards associated with the use of the equipment include materials (both stored materials and elements of the building construction) in too close a proximity to the heater or flue, deficiencies in the installation and inadequate maintenance.

When using waste oil, the fuel has to be heated to between 80°C and 90°C for mineral oils and up to 140°C for vegetable oils in a small day tank before it is atomised with compressed air and fed into the burner unit. Hazards associated with the fuel include contamination and poor storage conditions.

Where solid fuels are employed, their storage and handling is again of importance, and when sawdust is used, it could propagate explosions if mishandled.

Because of the potential fire hazards, portable heaters burning waste fuel should only be used in strictly controlled conditions.

## ➤ DEFINITIONS

### **Biomass heaters**

Heating equipment that uses materials of biological origin that would, in the context of this document, otherwise be classified as waste, for the production of heat.

## **Legislation**

Various items of legislation are applicable to the burning of certain waste fuels and the Environment Agency (in England and Wales), the Scottish Environment Protection Agency or the Northern Ireland Environment Agency should be contacted for guidance for complying with the legislation and licensing needs before any waste fuels are utilised for heating. In some instances, a licence has to be obtained from the local authority but detailed guidance will be provided by the reference bodies.

### **Waste fuel**

This term is used in this document to mean fuels that could be regarded as waste or by-products of processes and include waste oil, wood (including sawdust), straw and other combustible waste materials.

### **Waste oil**

Waste oil can also be described as used oil and can include motor engine and gearbox oils, transmission fluids, hydraulic oils, metalworking oils such as cutting and grinding oils, and also vegetable and cooking oils.

## ➤ INTRODUCTION

Until recently, many potential fuels were considered to be of little economic value and created problems relating to their disposal. Today, however, the use of many waste products is looked upon as environmentally sound, a financial benefit and also a satisfactory approach to the management of such waste.

Several factors have led to this new interest in waste fuels. Probably the most important of these is the high cost and problems of waste disposal. More restrictions are being placed on landfill and other methods of disposal and the use of waste for heating is regarded by some as a 'green' approach to the problem.

## ➤ RECOMMENDATIONS

### **1. General considerations**

- 1.1 Flammable and highly flammable liquids fall within the definition of 'dangerous substances' as referred to in the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) (ref. 3). Where a dangerous substance is either present or likely to be present at the workplace, a suitable assessment of the risks likely to arise should be conducted and action taken to eliminate or reduce the identified hazards.
- 1.2 In addition to complying with the DSEAR Regulations, a suitable and sufficient fire risk assessment of the whole workplace should be undertaken to satisfy the requirements of the Regulatory Reform (Fire Safety) Order 2005 or equivalent legislation for Scotland and Northern Ireland (refs. 4-6).
- 1.3 Where a fire risk assessment has already been carried out and proposals to alter any heating arrangements are being considered, the fire risk assessment should be reviewed to ascertain if the proposed arrangements are acceptable from the life safety perspective and identify any further general fire precautions that may need to be implemented to minimise the fire hazards to the property.
- 1.4 At the planning stage, confirmation should be sought from the manufacturer or supplier of the equipment that

it is suitable for use with the proposed fuel. At this time, the safety controls required and any supplementary processes to which the fuel should be subject (such as drying of timber or filtering of oils) should be determined and appropriate equipment and management measures put in place for their implementation.

- 1.5 All equipment should be installed, maintained and serviced by a competent person in accordance with the manufacturer's recommendations. The servicing should include thorough cleaning of the equipment itself and checking of the safety controls for correct action.
- 1.6 Heaters should be operated by personnel who have been trained in the use of the specific equipment that is installed.
- 1.7 All ancillary parts of the installation, such as flues, should also be maintained in accordance with the manufacturer's or installer's recommendations. This is particularly important in the case of wood burning stoves, where frequent cleaning is required. This is because soot and tar from wood fires build up more rapidly than is the case when other types of fuel are used.
- 1.8 Following installation, no alteration should be made to the heating equipment or the type, form or method of processing of the fuel without reference to the manufacturer.

## **2. Oil-fired heating equipment**

- 2.1 In the case of fixed waste oil-fired installations, reference should be made to the recommendations for oil-fired heating installations (RC9: **Recommendations for oil-fired heating installations**) (ref. 7). While that document makes specific reference to the fact it does not apply to installations fuelled with waste oil, the recommendations are appropriate, subject to:
  - a) either the heater being specifically manufactured to burn waste oil; or
  - b) consultation with the manufacturer in advance of the heater being used for the burning of waste oil if it was not specifically manufactured for this purpose.
- 2.2 Where practicable:
  - a) the heater should be located in a separate compartment constructed of brick or concrete block and with an appropriate ceiling and door to provide 60-minutes' fire separation from the remainder of the premises. A clear space of at least 1m should be maintained around the heater; and
  - b) if the heater is not located in a dedicated enclosure, a metal guard should be installed to provide a clear space of at least 1m from combustible or flammable materials (including the structure of the building) and also to provide protection against impact damage.
- 2.3 Filling the day tank can be a hazardous process; the filling procedure should be undertaken by the trained person strictly in accordance with the manufacturer's instructions.
- 2.4 Care must be taken in assuring the quality of the waste fuel oil supplies as contamination with a very small volume of petrol can effect the flashpoint of the fuel to a significant extent.

## **3. Wood burning stoves**

Wood burning stoves may utilise timber, wood chips or pellets produced from compressed sawdust from forest thinning. The delivery of the fuel to the boiler may be by hand or by auger screw from a hopper in an adjacent area. Wood chips or pellets may be blown into the hopper or storage area by the delivery vehicle.

Wood pellets have benefits in that due to their low moisture content, between 8% and 10%, they have an energy content similar to high grade coal. This coupled with their small size and relatively high surface area means it is possible to transport large quantities over long distances realising economies of scale.

The boilers have a flue for carrying away smoke and providing a draught. They are nearly all provided with a means of varying the draught by opening or closing dampers.

The use of spark arrestors to prevent sparks being emitted from the flue is against current thinking as these cause the flue to soot up to a greater extent, restricting the escape of combustion gases and retaining heat for longer in the flue or chimney. This build up of heat has potential for igniting combustible materials close to, or against the flue.

- 3.1 Where spark arrestors are already installed, a competent person should be engaged to clean the flue more frequently than would otherwise be the case. Consideration should be given to cleaning of the flue quarterly or more frequently still if required by a fire risk assessment. The spark arrestor should be readily accessible and be inspected on each occasion that the flue is cleaned. The spark arrestor should be cleaned or replaced at this time as necessary.
- 3.2 If a wood burning stove is to be used in a wooden floored building, it should be stood on a base or hearth of non-combustible material thick enough to protect the floor against heat. The slab should preferably be of concrete not less than 75mm in thickness and extend at least 0.5m on each side and particularly at the front, where ash and other burnt or partly burnt material are likely to fall from the firing opening. A sheet of metal beneath the heater is not satisfactory because it readily transmits heat.
- 3.3 A fixed fender of metal, brick or concrete should be provided to assist in preventing ash and similar hot materials falling onto the floor.
- 3.4 The burning of wet or unseasoned wood should be avoided, as this will leave greater deposits of combustible materials in the flue or chimney.
- 3.5 Only proprietary stoves should be used for heating commercial and industrial properties; there are many forms of wood burning stoves and a small number of sawdust burning stoves available. No attempt should be made to utilise home-built sawdust burners as many designs of these rely on radiated heat from the flue to heat the building.
- 3.6 A wood burning stove should not be used in heritage or thatched premises without reference to the insurer of the property.
- 3.7 Wood burning stoves should not be left unattended for prolonged periods of time.

#### 4. Storage of bulk supplies of fuel

- 4.1 Advice should be sought from the appropriate Environment Agency in advance of the use or storage of any waste fuel to ensure compliance with appropriate environmental and other legislation.
- 4.2 Storage of waste oil shall be in accordance with the requirements of the Environment Agency (in England and Wales), the Scottish Environment Protection Agency or the Northern Ireland Environment Agency, who should be contacted for guidance for complying with the legislation and licensing needs before any waste fuels are stored.
- 4.3 Although the waste oil may not technically be a flammable liquid, it is recommended that the advice concerning their storage and use that is set out in RC20: Parts 1 and 2 (**Recommendations for fire safety in the storage and use of highly flammable and flammable liquids, Part 1: General Principles** and **Part 2: Storage in drums, cans and containers other than external fixed tanks**) and in RC57 (**Storage and use of highly flammable and flammable liquids in external fixed tanks**) (refs. 8-10) be observed.
- 4.4 Bulk supplies of fuel should be stored in a separate building or structure or in a manner that provides at least 60-minutes' fire separation between the fuel and the heater.
- 4.5 Stored fuel should be kept secure against the threat of deliberate fire raising. Bulk supplies of fuel should also be kept secure against theft; it has been known for attempts to be made to steal liquid fuel using 'hot-piping' of storage containers (ie inserting hot pipes into the containers to access and siphon the contents). This presents a serious fire hazard.
- 4.6 Some wood burning stoves use wood chips or sawdust as the fuel. Sawdust has been tested extensively over many years and it has been found that the greater the proportion of oil present in the wood, the lower the critical ignition temperature (the temperature at which a runaway reaction occurs). The susceptibility to self heating is also dependent on the size of the particles, the size of the piles, their age, poor air flows, the presence of impurities and low ratio of surface area to volume.
- Bulk supplies of wood chips and sawdust should be:
- a) monitored using probe or recording thermometers to monitor the temperature and the fire and rescue service called if the temperature rises above 70°C;
  - b) used in rotation;
  - c) kept well ventilated;
  - d) kept free of contamination, especially from drying oils (such as linseed oil);
  - e) stored such that hot, humid storage conditions are avoided; and
  - f) kept at least 15m from any significant building and clear of any combustible materials such as grass, brush and rubbish.
- 4.7 No wood or straw for burning should be kept in the building within 5m of the stove.

- 4.8 Care should be taken to prevent contamination of all stored fuel supplies; this includes wood and sawdust, as well as oil.

#### 5. Flues

- 5.1 The flue pipe should be of metal. Where it penetrates combustible elements of roofs and ceilings the following should be considered:
- a) an insulating and non-combustible collar fitted around the pipe with a minimum thickness of 40mm;
  - b) a proprietary sleeve system installed around the pipe with at least 60-minutes' fire resistance in terms of insulation and integrity; or
  - c) combustible material should be cut back leaving a space of at least 100mm around the flue pipe.
- In the case of wood burning stoves, insulated flue linings should be used in all cases where flues pass through or close to combustible materials.
- 5.2 The use of single-walled flues should be avoided. Even where double-skin flues are used, a clear space of at least 1m from combustible materials should be maintained around the flue pipes within the building.
- 5.3 Flues should be vertical and changes in direction should be avoided wherever possible.
- 5.4 The instructions provided by the manufacturers for the installation of the flues shall be followed.
- 5.5 All parts of any flue pipe should be accessible to allow regular cleaning to prevent the build up of tar, soot and other deposits (see also section 3.6). The frequency of cleaning will depend upon the build up of deposits, which should be monitored. In general, cleaning should be in line with the manufacturer's instructions or more frequent should a risk assessment of the flues determine otherwise.
- 5.6 The cleaning and inspecting of flues should be undertaken by a competent person, accredited by HETAS or a similar organisation.
- 5.7 In the case of existing unlined brickwork flues, the condition of these should be examined periodically by CCTV camera equipment to identify any defects in the structure.
- 5.8 The fire should always be allowed to go out at least 24 hours before cleaning, maintenance or internal inspections of flues.

#### 6. Fire protection

- 6.1 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: **Fire extinguishing installations and equipment of premises: Selection and installation of portable fire extinguishers – Code of practice** (ref. 11) and be serviced in compliance with BS 5306-3: **Fire extinguishing installations and equipment of premises: Code of practice for the commissioning and maintenance of portable fire extinguishers** (ref. 12).
- 6.2 Where determined from the fire risk assessment for the premises an automatic fire detection and alarm system should be installed and maintained in accordance with BS 5839-1: **Fire detection and fire alarm system for buildings: Code of practice for system design,**



**installation, commissioning and maintenance** (ref. 13).

Where there is a need for such a system, it should be designed, installed, commissioned and maintained by a company approved and certificated by an independent third party certification body.

- 6.3 Where auger screws are used for feeding the fuel to the boiler a suitable fire suppression system should be installed. Such an installation should be designed, installed, commissioned and maintained by a company approved and certificated by an independent third party certification body.
- 6.4 Where determined by the fire risk assessment concerning a sawdust fuelled installation, consideration should be given to the installation of an appropriate explosion suppression system.

**7. Fire safety management**

- 7.1 Sawdust dispersed in the atmosphere is a serious explosion hazard. Any spillage of sawdust should be cleared up with a vacuum cleaner designed for this purpose. The use of a brush should be avoided as it may distribute sawdust particles in the air to an extent that an explosive atmosphere may be produced. This could then be ignited by a flame or hot surface. This initial explosion may then disturb further deposits of sawdust and result in more powerful secondary explosions.
- 7.2 Spilled waste oil should be cleared up as soon as possible and supplies of suitable absorbent materials should be held on site and be immediately available for this purpose.
- 7.3 Particular care should be taken when sawdust is used as a source of fuel due to the potential for explosible concentrations of dust to accumulate in the atmosphere at times when supplies of sawdust are being delivered to site or transferred to the burner. All processes that involve the movement of sawdust should be subject to a risk assessment in accordance with the Dangerous Substances and Explosive Atmosphere Regulations 2002 (DSEAR) (ref. 3), with hazard zones being identified and managed in order to eliminate potential ignition sources from areas where explosible concentrations of dust might occur. Further information is set out in RC12: **Recommendations for the prevention and control of dust explosions** (ref. 14).
- 7.4 Care must also be taken to prevent the build up of static electricity when sawdust or oils are being handled or moved via pipework. All extraneous metal components should be bonded and earthed. Similarly, sawdust silos and associated components should be bonded and earthed and suitable earthing leads should be available for attaching to delivery vehicles.

## 8. Checklist

		Yes	No	N/A	Action required	Due date	Sign on completion
<b>8.1</b>	<b>General considerations (section 1)</b>						
8.1.1	Where a dangerous substance is either present or likely to be present at the workplace, has a suitable assessment of the risks likely to arise been conducted in accordance with the Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) and has action been taken to eliminate or reduce the identified hazards? (1.1)						
8.1.2	In addition to complying with DSEAR, has a suitable and sufficient fire risk assessment of the whole workplace been undertaken to satisfy the requirements of the Regulatory Reform (Fire Safety) Order 2005 or equivalent legislation for Scotland and Northern Ireland? (1.2)						
8.1.3	Where a fire risk assessment has already been carried out and proposals to alter any heating arrangements are being considered, has the fire risk assessment been reviewed to ascertain if the proposed arrangements are acceptable from the life safety perspective, and in order to identify any further general fire precautions that may need to be implemented to minimise the fire hazards to the property? (1.3)						
8.1.4	At the planning stage, has confirmation been sought from the manufacturer or supplier of the equipment that it is suitable for use with the proposed fuel? (1.4)						
8.1.5	Has all equipment been installed, maintained and serviced by a competent person in accordance with the manufacturer's recommendations? (1.5)						
8.1.6	Are heaters operated by personnel who have been trained in the use of the specific equipment that is installed? (1.6)						
8.1.7	Are all ancillary parts of the installation, such as flues, also maintained in accordance with the manufacturer's or installer's recommendations? (1.7)						
8.1.8	Is the heating equipment free of any alteration that has been made to the equipment or the type, form or method of processing of the fuel without reference to the manufacturer? (1.8)						
<b>8.2</b>	<b>Oil-fired heating equipment (section 2)</b>						
8.2.1	Has consultation been undertaken with the manufacturer in advance of the heater being used for the burning of waste oil if it was not specifically manufactured for this purpose? (2.1)						
8.2.2	Is the heater located in a separate compartment constructed of brick or concrete block and with an appropriate ceiling and door to provide 60-minutes' fire separation from the remainder of the premises? (2.2)						
8.2.3	Is a clear space of at least 1m maintained around the heater? (2.2)						

		Yes	No	N/A	Action required	Due date	Sign on completion
8.2.4	If the heater is not located in a dedicated enclosure, has a metal guard been installed to provide a clear space of at least 1m from combustible or flammable materials (including the structure of the building) and also to provide protection against impact damage? (2.2)						
8.2.5	Filling the day tank can be a hazardous process; is the filling procedure undertaken by a trained person strictly in accordance with the manufacturer's instructions? (2.3)						
8.2.6	Is care taken in assuring the quality of the waste fuel oil supplies? (2.4)						
<b>8.3</b>	<b>Wood burning stoves (section 3)</b>						
8.3.1	Where spark arrestors are installed, has a competent person been engaged to clean the flue more frequently than would otherwise be the case? (3.1)						
8.3.2	If a wood burning stove is to be used in a wooden floored building, is it stood on a base or hearth of non combustible material thick enough to protect the floor against heat? (3.2)						
8.3.3	Is a fixed fender of metal, brick or concrete provided to assist in preventing ash and similar hot materials falling onto the floor? (3.3)						
8.3.4	Is the burning of wet or unseasoned wood avoided? (3.4)						
8.3.5	Are only proprietary stoves used for heating commercial and industrial properties? (3.5)						
8.3.6	If a wood burning stove is being used in heritage or thatched premises, has reference been made to the insurer of the property? (3.6)						
8.3.7	Are staff always present when wood burning stoves are being used? (3.7)						
<b>8.4</b>	<b>Storage of bulk supplies of fuel (section 4)</b>						
8.4.1	Has advice been sought from the appropriate Environment Agency in advance of the use or storage of any waste fuel to ensure compliance with appropriate environmental and other legislation? (4.1)						
8.4.2	Is storage of waste oil in accordance with the requirements of the Environment Agency (in England & Wales), the Scottish Environment Protection Agency or the Northern Ireland Environment Agency? (4.2)						
8.4.3	Although the waste oil may not technically be a flammable liquid, has the best practice set out in RC20: Parts 1 and 2 and in RC57 been observed? (4.3)						



		Yes	No	N/A	Action required	Due date	Sign on completion
8.4.4	Are bulk supplies of fuel stored in a separate building or structure or in a manner that provides at least 60-minutes' fire separation between the fuel and the heater? (4.4)						
8.4.5	Is stored fuel kept secure against the threat of deliberate fire raising, and are bulk supplies of fuel also kept secure against theft? (4.5)						
8.4.6	Are bulk supplies of wood chips and sawdust: <ul style="list-style-type: none"> <li>• monitored using probe or recording thermometers to monitor the temperature and the fire and rescue service called if the temperature rises above 70°C?;</li> <li>• used in rotation?;</li> <li>• kept well ventilated?;</li> <li>• kept free of contamination, especially from drying oils (such as linseed oil)?;</li> <li>• stored such that hot, humid storage conditions are avoided?; and</li> <li>• kept at least 15m from any significant building and clear of any combustible materials such as grass, brush and rubbish? (4.6)</li> </ul>						
8.4.7	Is the area within 5m of the stove clear of wood or straw for burning? (4.7)						
8.4.8	Is care taken to prevent contamination of stored fuel supplies (this includes wood and sawdust, as well as oil)? (4.8)						
<b>8.5</b>	<b>Flues (section 5)</b>						
8.5.1	Is the flue pipe made of metal? Where it penetrates combustible elements of roofs and ceilings, has consideration been given to: an insulating and non-combustible collar being fitted around the pipe; a proprietary sleeve system installed around the pipe giving at least 60-minutes' fire resistance; or have combustible materials cut back leaving a space of at least 100mm around the flue pipe? (5.1)						
8.5.2	In the case of wood burning stoves, have insulated flue linings been used in all cases where flues pass through or close to combustible materials? (5.1)						
8.5.3	Has the use of single-walled flues been avoided? (5.2)						
8.5.4	Are flues vertical and with changes in direction avoided wherever possible? (5.3)						
8.5.5	Have the instructions provided by the manufacturers for the installation of the flues been followed? (5.4)						
8.5.6	Are all parts of any flue pipe accessible to allow regular cleaning to prevent the build up of tar, soot and other deposits? (5.5)						
8.5.7	Is the frequency of cleaning the flues dependent on the build up of deposits? Are those deposits monitored? (5.5)						

		Yes	No	N/A	Action required	Due date	Sign on completion
8.5.8	Is the cleaning and inspection of flues undertaken by a competent person accredited by HETAS or a similar organisation? (5.6)						
8.5.9	Are existing unlined brickwork flues examined periodically by CCTV camera equipment to identify defects in the structure? (5.7)						
8.5.10	Is the fire allowed to go out at least 24 hours before cleaning, maintenance or internal inspection of flues? (5.8)						
<b>8.6</b>	<b>Fire protection (section 6)</b>						
8.6.1	Are a suitable number of appropriate portable fire extinguishers, approved and certificated by an independent, third party certification body, provided and serviced annually? (6.1)						
8.6.2	Where determined from the fire risk assessment for the premises, is an automatic fire detection and alarm system installed and maintained in accordance with BS5839-1? (6.2)						
8.6.3	Where auger screws are used for feeding the fuel to the boiler, has a suitable fire suppression system been installed? (6.3)						
8.6.4	Where determined by the fire risk assessment concerning a sawdust fuelled installation, has consideration been given to the installation of an appropriate explosion suppression system? (6.4)						
<b>8.7</b>	<b>Fire safety management (section 7)</b>						
8.7.1	Sawdust dispersed in the atmosphere is a serious explosion hazard. Are all spillages of sawdust cleared up with a vacuum cleaner designed for this purpose? (7.1)						
8.7.2	Is spilled waste oil cleared up as soon as possible and are supplies of suitable absorbent materials held on site and immediately available for this purpose? (7.2)						
8.7.3	Is particular care taken when sawdust is used as a source of fuel at times when supplies of sawdust are being delivered to site or transferred to the burner? (7.3)						
8.7.4	Are all processes that involve the movement of sawdust subject to a risk assessment in accordance with DSEAR with hazard zones being identified and managed in order to eliminate potential ignition sources from areas where explosive concentrations of dust might occur? (7.3)						
8.7.5	Is care taken to prevent the build up of static electricity when sawdust or oils are being handled or moved via pipework and are all extraneous metal components bonded and earthed? (7.4).						
8.7.6	Are sawdust silos and associated components bonded and earthed and are suitable earthing leads available for attaching to delivery vehicles? (7.4)						

## ➤ REFERENCES

1. RC15: **Recommendations for the use of portable and transportable heaters in commercial and industrial premises**, 2006, Fire Protection Association.
2. RC46: **Fire safety in the manufacture of biodiesel fuel**, 2009, Fire Protection Association.
3. Dangerous Substances and Explosive Atmosphere Regulations 2002 (DSEAR). SI 2002 No. 2776. The Stationery Office.
4. Regulatory Reform (Fire Safety) Order 2005. SI 2005 No 1541. The Stationery Office.
5. Fire Safety (Scotland) Regulations 2006. Scottish SI 2006 No 456. The Stationery Office.
6. Fire and Rescue Services (Northern Ireland) Order 2006. SI 2006 No 1254 (NI9). The Stationery Office.
7. RC9: **Recommendations for oil-fired heating installations**, 2007, Fire Protection Association.
8. RC20: **Recommendations for fire safety in the storage and use of highly flammable and flammable liquids, Part 1: General Principles**, 2006, Fire Protection Association.
9. RC20: **Recommendations for fire safety in the storage and use of highly flammable and flammable liquids, Part 2: Storage in drums, cans and containers other than external fixed tanks**, 2007, Fire Protection Association.
10. RC57: **Storage and use of highly flammable and flammable liquids in external fixed tanks**, 2009, Fire Protection Association.
11. BS 5306-8: **Fire extinguishing installations and equipment of premises: Selection and installation of portable fire extinguishers. Code of practice**, British Standards Institution.
12. BS 5306-3: **Fire extinguishing installations and equipment of premises: Code of practice for the commissioning and maintenance of portable fire extinguishers**, British Standards Institution.
13. BS 5839-1: **Fire detection and fire alarm system for buildings: Code of practice for system design, installation, commissioning and maintenance**, British Standards Institution.
14. RC12: **Recommendations for the prevention and control of dust explosions**, 2004, Fire Protection Association.

## ➤ FURTHER READING

The HETAS Guide may be found at [http://www.hetas.co.uk/public/hetas\\_guide.html](http://www.hetas.co.uk/public/hetas_guide.html)

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