

**IGEM/UP/10 Edition 4 with amendments - March 2016
Communication 1786**

Installation of flued gas appliances in industrial and commercial premises



*Founded 1863
Royal Charter 1929
Patron: Her Majesty the Queen*

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SECTION 1 : INTRODUCTION

- 1.1 This Standard supersedes IGEN/UP/10 Edition 4, Communication 1774.
- 1.2 This Standard has been drafted by a Panel appointed by the Institution of Gas Engineers and Managers' (IGEM's) Gas Utilization Committee and is published by the authority of IGEM's Council.
- 1.3 This Standard covers the installation of a range of flued gas appliances including:
- hot water boilers
 - steam boilers
 - storage water heaters
 - thermal fluid heaters
 - warm air heaters
 - radiant heaters.

This Standard does not cover process plant applications (due to their complexity) but sections of this Standard, such as Appendix 5, may be relevant to such applications. Requirements for such applications are given in IGE/UP/12.

- 1.4 This Standard covers hot water boilers of net heat input exceeding 70 kW and not exceeding 20 MW. Hot water boilers of gross heat input not exceeding 2 MW (1.8 MW net) are also covered in BS 6644. This Edition 4 of IGEN/UP/10 aligns requirements for appliances with those of the recently revised BS 6644, BS 6230 and BS 6896 and provides detailed design information for flues/chimneys. Other changes have been made to clarify aspects of Edition 3 in the light of practical experience.

Both IGEN/UP/10 and BS 6644 allow deviation from prescribed ventilation and chimney requirements, for example for summer heating loads or to meet the requirements of the Local Authority (normally the Environmental Health Officer). It is a requirement that any calculations, methods of assessment and conclusions are recorded and retained with the plant records. A system design verification notice (SDVN) to that effect is required to be displayed to assist those performing work on the installation (see Appendix 4). In this respect, any deviation from the requirements of this Standard needs to be made by a Competent Person with respect to gas safety issues (see Sub-Section 3.2.10).

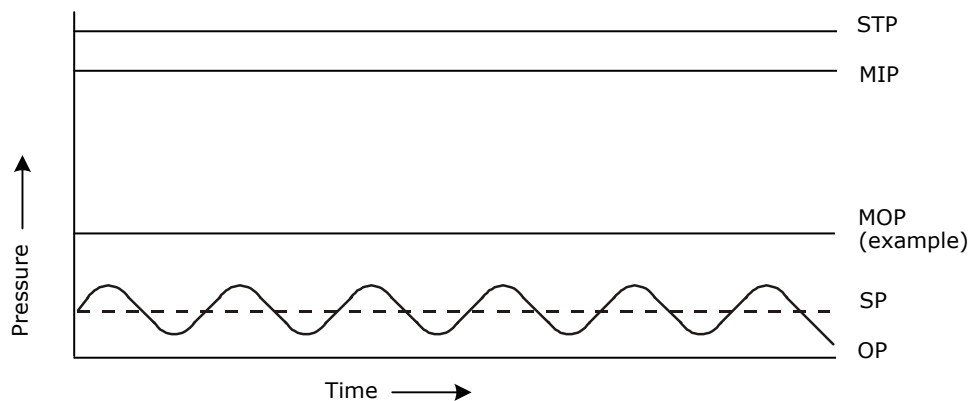
Note: This Standard uses the term "chimney" to reflect the construction element of a system.

- 1.5 This Standard does not contain any references to the heated medium of appliances, for instance water, air, etc. It is important to refer to the manufacturer's instructions for information relating to the appliance and the heating medium.

Note: Attention is also drawn to the Water Supply (Water Fittings) Regulations, as amended, which apply to the design and installation of all water systems designed to BS EN 13831, BS 5422, BS 5449, (BS EN 12828, BS EN 12831 and BS EN 14336), BS 5546, BS 5970, BS 6283, BS 6700 (BS EN 806-2), BS 6880 and BS 7593.

- 1.6 This Standard reflects current best practice and is aligned with national/international legislation and standards. However, where appropriate, additional guidance, interpretation and clarification have been provided. Applicable references for legislation, standards, etc. are listed in Appendix 2.
- 1.7 Terms such as "maximum operating pressure" (MOP), "maximum incidental pressure" (MIP) and "operating pressure" (OP) reflect gas pressure terminology used in European standards.

Referring to Figure 1, attention is drawn to how OP oscillates about the set point (SP). Note also that MOP can be declared at a higher value than OP. The strength test pressure (STP) has to be at least MIP and, in many cases, will exceed MIP. This means that, at least with respect to integrity, the installation will withstand a fault pressure from the upstream system.



STP	=	strength test pressure
MIP	=	maximum incidental pressure
OP	=	operating pressure
MOP	=	maximum operating pressure
SP	=	set point of the regulator.

Note: This is extracted from IGEN/TD/13 and simplified for the purposes of IGEN/UP/10.

FIGURE 1 – RELATIVE PRESSURE LEVELS

1.8 This Standard makes use of the terms “must”, “shall” and “should” when prescribing particular requirements. Notwithstanding Sub-Section 1.11:

- the terms “must” identifies a requirement by law in Great Britain (GB) at the time of publication
- the term “shall” prescribes a requirement which, it is intended, will be complied with in full and without deviation
- the term “should” prescribes a requirement which, it is intended, will be complied with unless, after prior consideration, deviation is considered to be acceptable.

1.9 It is now widely accepted that the majority of accidents in industry are in some measure attributable to human as well as technical factors in the sense that actions by people initiated or contributed to the accidents, or people might have acted better to avert them.

It is therefore necessary to give proper consideration to the management of these human factors and the control of risk. To assist in this, it is recommended that due cognisance be taken of HSG48 and HSG65.

1.10 The primary responsibility for compliance with legal duties rests with the employer. The fact that certain employees, for example, “responsible engineers”, are allowed to exercise their professional judgement does not allow employers to abrogate their responsibilities. Employers must:

- have done everything to ensure, as far as is reasonably practicable, that there are no better protective measures that can be taken other than relying on the exercise of professional judgement

- have done everything to ensure, so far as is reasonably practicable, that “responsible engineers” have the skills, training, experience and personal qualities necessary for the proper exercise of professional judgement
- have systems and procedures in place to ensure that the exercise of professional judgement by “responsible engineers” is subject to appropriate monitoring and review
- not require “responsible engineers” to undertake tasks which would necessitate the exercise of professional judgement that is beyond their competence. There should be written procedures defining the extent to which “responsible engineers” can exercise their judgement. When “responsible engineers” are asked to undertake tasks which deviate from this, they should refer the matter for higher review.

These principles equally apply to designated/delegated employees, contractors, etc.

- 1.11 Notwithstanding Sub-Section 1.8, this Standard does not attempt to make use of any method or specification obligatory against the judgement of the responsible engineer. Where new and better techniques are developed and proved, they should be adopted without waiting for modification to this Standard. Amendments to this Standard will be issued when necessary and their publication will be announced in the Journal of the Institution and other publications as appropriate.
- 1.12 Requests for interpretation of this Standard in relation to matters within their scope, but not precisely covered by the current text, should be addressed to Technical Services, IGEN, High Street, Kegworth, Derbyshire DE74 2DA or via email to technical@igem.org.uk and will be submitted to the relevant Committee for consideration and advice, but in the context that the final responsibility is that of the engineer concerned. If any advice is given by, or on behalf of IGEN, this does not relieve the responsible engineer of any of his or her obligations.
- 1.13 This Standard was published in March 2016. Amendments have been made to this Standard and are indicated by ► ◀.

SECTION 2 : SCOPE

2.1 This Standard sets down the minimum requirements (see Note 1) applicable to gas fired open flued and room sealed appliances, including:

- hot water boilers of net heat input exceeding 70 kW
- steam boilers
- thermal fluid heaters
- storage water heaters of net heat input exceeding 70 kW
- warm air heaters of net heat input exceeding 70 kW
- radiant heaters.

This Standard covers such equipment for net heat input not exceeding 20 MW.

Note 1: This Standard specifies the minimum acceptable requirements for safe installation and use, as such any relaxation from these requirements needs to be referred to IGEN (see Sub-Section 1.8).

Note 2: This Standard applies to instances where an appliance installation (not exceeding 70 kW net heat input) is associated with other appliances in a plant room where the total net heat input exceeds 70 kW. However it is to be noted that this Standard incorporates more stringent requirements than those in BS 5440 for appliance installations below 70 kW.

Note 3: This Standard does not apply to flueless heaters such as direct-fired radiant and direct-fired warm air heaters (see BS 6896 or BS 6230) or applications within process plant such as ovens/furnaces (see IGE/UP/12), although certain requirements may be of relevance.

- *Note 4: The ratio of gross to net heat input is, approximately, 1.11:1, 1.09:1 and 1.08:1 for appliances on Natural Gas (NG)/Town's Gas, propane and butane respectively. For the purposes of this Standard, where gross heat inputs represent requirements of existing standards, they are converted to net using a conversion factor in all cases. For example, 600 kW gross heat input = $600 \div 1.1 = 545$ kW net heat input for NG. ◀.*

Note 5: For appliances of heat input not exceeding those stated, installed in rooms and compartments, the appropriate British Standard applies. However, where the appliance is located within a heated space such as within a factory or warehouse, clause 7.5.4 or Sub-Section 7.6 applies with respect to alternative ventilation arrangements.

2.2 This Standard covers the design aspect of flues and exhausts for gas engines exceeding 70 kW net heat input and all gas turbines, both not exceeding 20 MW. The ventilation requirements for such appliances are covered by IGE/UP/3 and IGE/UP/9 respectively and the detailed requirements of the manufacturer's instructions.

2.3 This Standard applies to individual or groups of appliances installed in a single space.

Note: The scope includes multiples of small appliances, for example 2 off 36 kW net heat input appliances. For chimneys/flues and ventilation for smaller installations of single appliances not exceeding 70 kW net, BS 5440 applies.

2.4 This Standard covers flammable gases, as defined in BS EN 437, for example, NG, manufactured gas, bio-gases, Liquefied Petroleum Gas (LPG) and LPG/Air.

Note: This Standard also applies to the installation of bio-fuelled appliances in conjunction with existing or new gas appliances (for more information see clause 5.1.6, Section 12 and Appendix 6).

2.5 This Standard applies to new installations and it is not the intention to apply any requirements retrospectively. However, if existing plant is being upgraded, it is recommended that the intent of this Standard be followed as far as reasonably practicable. A risk assessment is required whenever changes are proposed for any plant (see IGE/SR/24 and IGEN/UP/16).

- 2.6 This Standard applies to the essential aspects of installing appliances and to retro-fitting of burners to existing appliances.
- Note: This Standard does not cover the water, steam or warm air elements of installations (see Sub-Section 1.5).*
- 2.7 All pressures are gauge pressures unless otherwise stated.
- 2.8 All heat inputs are net heat inputs unless otherwise stated.
- 2.9 Italicised text is informative and does not represent formal requirements.
- 2.10 Appendices are generally informative and do not represent formal requirements unless specifically referenced in the main sections by the prescriptive terms "must", "shall" or "should".

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SECTION 3 : LEGISLATION

This Standard is set out against a background of legislation in force in the UK at the time of publication. The devolution of power to the Scottish, Welsh and Northern Ireland Assemblies means that there may be variations to the legislation described below for each of them and consideration of their particular requirements must be made. Similar considerations are likely to apply in other countries and reference to appropriate national legislation will be necessary.

Appendix 2 lists legislation, guidance notes, standards, etc. which are identified within this Standard as well as further items of legislation and standards that may be applicable. Where standards are quoted, equivalent national or international standards, etc. equally may be appropriate. Unless otherwise stated, the latest version of the referenced document should be used.

3.1 PRIMARY LEGISLATION

3.1.1 Clean Air Act

The Act applies to gas (and other fuels) fired appliance installations generally but with specific requirements for installations exceeding 366.4 kW total gross heat input, (333 kW net heat input) including approval of the height of the chimney by the Local Authority. The essential requirements are that flue discharges are not to cause a nuisance to others or be a hazard to health.

Note 1: The Third Edition of the 1956 Clean Air Act Memorandum (CAAM) on Chimney Heights is a guide for the design of chimneys and flues. It contains methods of determining chimney heights and design requirements for fan diluted flue systems ➤(see Appendix A3.1 for further explanation). ◀

Note 2: The essential requirements may also fall within the scope of the Health and Safety at Work etc. Act, the local air quality management section of the Environment Act and other Acts, regardless of heat input, which would encompass all installations within the scope of this publication.

Note 3: This Standard contains updated information on chimney heights and terminations not currently contained within CAAM.

3.1.2 Health and Safety at Work etc. Act (HSWA)

HSWA applies to all persons involved with work activities, including employers, the self-employed, employees, designers, manufacturers, suppliers, etc. as well as the owners of premises. It places general duties on such people to ensure, so far as is reasonably practicable, the health, safety and welfare of employees and the health and safety of members of the public, who may be affected by the work activity.

3.2 SECONDARY LEGISLATION

3.2.1 Building Regulations

a) England and Wales (as amended)

Building Regulations are statutory instruments that are required to be followed when engaged in any building work. They are written in a format of broad Regulations, setting out simple requirements in a separate schedule. Suggested ways of complying with these Regulations are contained in Approved Documents.

The Approved Documents (AD) that apply to gas work are:

- A (Structure)
- B (Safety in Fire)
- F (Ventilation)
- G3 (Hot Water Storage)

- J (Heat Producing Appliances)
- L (Conservation of Fuel and Power)
- M (Access for Disabled People)
- P (Electrical Safety in Dwellings).

b) **Building (Scotland) Regulations**

The Building (Scotland) Regulations can be satisfied:

- by compliance with Technical Standards published by the Scottish Office
- conforming with the provisions of “deemed to satisfy” documents, for example British Standards
- other equivalent means.

c) **Equivalent Regulations and Standards, Wales, Northern Ireland and Isle of Man**

Equivalent Regulations and ADs apply in Northern Ireland and the Isle of Man and an awareness of these is required (see <http://www.dfpni.gov.uk/index/buildings-energy-efficiency-buildings/building-regulations/br-technical-booklets.htm> and <http://www.thenbs.com/BuildingRegs/>).

3.2.2 **Confined Spaces Regulations**

These Regulations apply to a whole range of confined spaces. The supplier or designer of an enclosure and equipment within it is required to perform a risk assessment of the enclosure with respect to safe access and egress and to give clear instructions to operators on access/egress as well as to what actions to take in the event of a gas alarm occurring. Employers and the self-employed are required to prevent entry into confined spaces unless avoidance is not reasonably practicable and unless there is a system of work which renders the work safe. They are also required to have specific emergency arrangements in place.

3.2.3 **Control of Asbestos at Work Regulations**

- 3.2.3.1 These Regulations set out standards for the identification, monitoring and assessment of work that may expose workers to asbestos and the measures needed to control the risk.
- 3.2.3.2 Employers cannot carry out any work that exposes, or is likely to expose, employees to asbestos unless an assessment of that exposure has been made. Employers have to set out steps to be taken to prevent, or reduce to the lowest level reasonably practicable, that exposure. Employers have to carry out medical surveillance of employees if they work over a certain time limit.
- 3.2.3.3 These Regulations impose a duty on those with responsibilities for the repair and maintenance of non-domestic premises to find out if there are, or may be, asbestos containing materials within them, to record the location and condition of such materials and assess and manage any risk from them, including passing of any information about their location and condition to anyone likely to disturb them.
- 3.2.3.4 Further information is available in HSG227. The ACoP and guidance associated with these Regulations is L143.

3.2.4 **Construction (Design and Management) Regulations (CDM)**

- These Regulations impose duties on designers, clients (and their agents), developers, principal designer and principal contractors. Further information is given in L153, which sets out the principles duty holders are required to use in their approach to identifying the measures they need to take to control the risks to health and safety in a particular project.

The general principles of prevention are to:

- avoid risks where possible
- evaluate those risks that cannot be avoided, and
- put in place proportionate measures that control them at source.

Construction includes the alterations, repair, re-decoration, maintenance, decommissioning or demolition of a structure. It also covers installation, commissioning, maintenance or removal of gas services. ◀.

3.2.5 **Construction Products Regulations**

3.2.5.1 These Regulations require the products to be CE marked and confers duties upon the manufacturers, importers and distributors.

3.2.5.2 They require the manufacturers to provide product identification, and both the manufacturers and importers to provide contact information and operating instructions and safety information.

In addition these Regulations require the manufacturers to:

- keep the technical documentation for a period of 10 years after the construction product has been placed on the market
- keep a register of all complaints about a product's non-conformance or product recalls, and keeping distributors informed of any product recalls
- adhere to specific marking requirements
- supply instructions and safety information in the language of the member state in which the product is being sold
- take immediate corrective measures if a product is found not to be in conformity with the product declaration of performance
- ensure that the product maintains its conformity with the declaration of performance after storage and distribution
- provide all relevant information about a product if a request is made by a competent national authority
- take into account changes in the product type and harmonised technical specifications.

3.2.6 **Control of Substances Hazardous to Health Regulations (COSHH)**

3.2.6.1 These Regulations, which reinforce existing statutory obligations under HSWA, impose a duty on employers to protect employees against risks to health, whether immediate or delayed, arising from exposure to substances hazardous to health, either used or encountered, as a result of a work activity. They also impose certain duties on employees.

3.2.6.2 Under COSHH, work is not be carried out which is liable to expose employees to hazardous substances unless the employer has made a suitable and sufficient assessment of the risk created by the work and the steps that need to be taken to comply with the Regulations. After assessing the risk, it is necessary to inform

employees of the risks and to carry out the appropriate training and instruction to ensure the risks are minimised. In certain cases, control measures such as ventilation or personal protective equipment may be necessary and, where provided, they have to be used.

3.2.7 **Dangerous Substances and Explosive Atmospheres Regulations (DSEAR)**

These Regulations are concerned with protection against risks from fire, explosion and similar events arising from dangerous substances used or present in the workplace. The Regulations require that risks from dangerous substances are assessed, eliminated or reduced. They contain specific requirements to be applied where an explosive atmosphere may be present and require the provision of arrangements to deal with accidents, emergencies etc. and provision of information, training and use of dangerous substances. These Regulations also require the identification of pipelines and containers containing hazardous substances.

The following publications contain details of the Regulations and their application:

- L138
- INDG 370.

3.2.8 **Electricity at Work Regulations**

These Regulations apply to a wide range of electrical work, from overhead power lines to the use of office computers and batteries and include work on gas equipment using electrical energy.

They are concerned with the prevention of danger from electric shock, electric burn, electrical explosion or arcing or from fire or explosion initiated by electrical energy.

They impose duties on every employer, employee and self-employed person and require that persons engaged in electrical work be competent or are supervised by competent persons.

Note: A "Memorandum of Guidance on the Electricity at Work Regulations 1989" is available from HMSO and gives useful information on the Regulations. Further advice is contained in HSR25.

3.2.9 **Gas Appliances (Safety) Regulations**

These Regulations define an "appliance" to mean an appliance burning gaseous fuel (that is to say, any fuel which is in a gaseous state at a temperature of 15 °C at a pressure of 1 bar) used for cooking, heating, hot water production, refrigeration, lighting or washing and having, where applicable, a normal water temperature not exceeding 105 °C and includes forced draught burners and heating bodies to be equipped with such burners but does not include an appliance specifically designed for use in an industrial process carried out on industrial premises. New appliances and fittings that fall within the Regulations are required to be CE marked.

3.2.10 **Gas Safety (Installation and Use) Regulations (GS(I&U)R)**

3.2.10 1 GS(I&U)R are relevant statutory provisions of HSWA, setting out general and detailed requirements dealing with the safe installation, maintenance and use of gas systems, including gas fittings, appliances and chimneys.

3.2.10.2 GS(I&U)R apply to a range of gases including manufactured gas, NG and LPG.

3.2.10.3 GS(I&U)R place responsibilities on those installing, servicing, maintaining or repairing gas appliances, pipework etc. as well as on suppliers and users of gas.

3.2.10.4 GS(I&U)R define the gas supplier for both NG and LPG and L56 provides guidance on those definitions, in particular for the more complicated case of LPG supplied from tanks and from cylinders.

3.2.10.5 GS(I&U)R define the type of work that requires persons carrying out such work, or their employers, to be an "approved class of person", for example Gas Safe registered.

Note: Guidance on the individual competencies required for persons carrying out gas work at premises not covered by GS(I&U)R is given in IGEN/IG/1.

3.2.10.6 ➤ The installer is required to check the safety of any appliance or pipework they install or work on and take appropriate action where they find faults. Where the premises are let or hired out, the landlord or hirer has special responsibilities to ensure that any installer they use for the gas fitting, service or maintenance or safety is a member of an approved class of persons (see clause 3.2.10.5) and is competent to carry out such work. If any serious fault is found, the installer is required to inform both the landlord/hirer, as well as the user, so that such faults can be rectified before further use. ◀

3.2.11 **Gas Safety (Management) Regulations (GS(M)R)**

3.2.11.1 GS(M)R place specific duties on gas transporters (GTs), or their emergency service providers (ESPs), for dealing with gas escapes from pipes on their networks. Their primary duty is to make the situation safe. They are responsible not only for dealing with escapes from their own pipes, but also for dealing with escapes from gas fittings supplied with gas from pipes on their network. In GS(M)R, the term "gas escapes" includes escapes or emissions of carbon monoxide (CO) from gas fittings.

3.2.11.2 The National Gas Emergency Service has specific duties to:

- provide a continuously staffed and free telephone service to enable persons to report gas escapes and
- pass such reports on to the person who has the responsibility for dealing with the escape.

National Grid plc is the entity that currently provides these services.

3.2.11.3 GS(M)R requires GTs to investigate fire and explosion incidents upstream of the emergency control valve (ECV) and to send a report of the investigation to HSE. GTs are also required to investigate fire and explosion incidents downstream of the ECV, but this is limited to establishing whether the seat of the fire or explosion was in an appliance and, if so, which one, or in the installation pipework.

3.2.11.4 Responsibility for investigating RIDDOR reportable incidents (see Sub-Section 3.2.16) as a result of an escape of CO from incomplete combustion of gas from a gas fitting, is placed on gas suppliers. HSE is required to be notified before such investigations commence.

Note: Advice on dealing with gas escapes is contained in IGEN/SR/29.

3.2.12 **Management of Health and Safety at Work Regulations (MHSWR)**

In addition to specific duties under GS(I&U)R (see Sub-Section 3.2.10) MHSWR impose a duty on employers and the self-employed to make assessments of risks to the health and safety of employees, and non-employees affected by their work. They also require effective planning and review of protective measures.

3.2.13 **Pressure Equipment Regulations (PER)**

3.2.13.1 These Regulations implement the Pressure Equipment Directive 97/23/EC. The Directive is intended to allow the free trade of pressure equipment throughout the European Union (EU). The Regulations deal with the manufacture, design and supply of pressure equipment. They impose duties on the responsible person who can either follow the requirements or they can follow the requirements of the legislation in force in the UK on 28th November 1999 (which were The Pressure Systems and Transportable Gas Containers Regulations 1989).

3.2.13.2 A "responsible person" is defined as:
"the manufacturer or his authorised representative established within the Community; or where neither the manufacturer nor his authorised representative is established within the Community, the person who places the pressure equipment or assembly on the market or puts it into service as the case may be".

3.2.13.3 "Pressure equipment" is defined as:
"vessels, piping, safety accessories and pressure accessories; where applicable, pressure equipment includes elements attached to pressurised parts, such as flanges, nozzles, couplings, supports lifting lugs and similar".

3.2.13.4 The duties on the "responsible person" are to ensure that pressure equipment:

- satisfies the relevant essential requirements
- has undergone the relevant conformity assessment procedure, if applicable
- has had the CE mark affixed by the manufacturer, if applicable
- has had the declaration of conformity drawn up by the manufacturer that the equipment is, in fact, safe.

3.2.13.5 Not all pressure equipment is covered by PER. There are 21 categories of exceptions, detailed in Sch (Schedule) 1.

The relevant conformity assessment procedure is determined by the classification of the pressure equipment according to criteria laid down in the Regulations. The classification system results in equipment being placed in one of five categories depending on the inherent level of hazard within the system.

The category then determines the range of conformity assessment modules relevant to that equipment. The modules are designed to allow the manufacturer to choose between a quality assurance route or type testing.

3.2.14 **Pressure Systems Safety Regulations (PSSR)**

3.2.14.1 These Regulations impose duties on designers, importers, suppliers, installers and user or owners to ensure that pressure systems do not give rise to danger. This is done by the correct design, installation and maintenance, provision of information, operation within safe operating limits and, where applicable, examination in accordance with a written scheme of examination drawn up or approved by a competent person (as defined by PSSR).

3.2.14.2 Relevant fluids for the purpose of this document would be NG at a pressure greater than 500 mbar above atmospheric pressure or LPG (which is a liquid with a vapour

pressure greater than 500 mbar at ambient temperature). A pressure system would include bulk storage tanks, pipelines and protective devices but not an LPG cylinder (transportable pressure receptacle). Once the pressure in the pipework drops below 500 mbar, and the user/owner can show clear evidence that the system does not contain, and is not liable to contain, a relevant fluid under foreseeable operating conditions, then that part of the system is no longer covered by the Regulations. This is likely to be the case downstream of the pressure relief valve associated with a pressure reducing valve which takes the pressure to below 500 mbar, for example at the entry to a building.

Note the special requirements placed on protective devices in such systems (see para 110b of L122). The Regulations also apply to pipelines and its protective devices in which the pressure exceeds 2 bar (see Sch 1 part 1 item 5 of L122).

3.2.14.3 More information is available in L122 and some information is presented in INDG 261.

3.2.15 **Provision and Use of Work Equipment Regulations (PUWER)**

3.2.15.1 The Regulations define work equipment as being any machinery, appliance, apparatus, tool or installation for use at work. Examples include spanners, wrenches, welding torches, ladders, lifting equipment and building services in common parts of a building.

3.2.15.2 They place duties on employers in relation to selection, suitability, maintenance, inspection, installation, instruction and training, prevention of danger and control of equipment.

3.2.15.3 More information on the Regulations can be found in L22, INDG 229 and INDG 291.

3.2.16 **Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR)**

3.2.16.1 RIDDOR require employers, self-employed people or those in control of work premises to report certain work related accidents, diseases and dangerous occurrences.

3.2.16.2 Other people have duties to report certain gas incidents, which may not appear to be work related:

- death or major injury arising out of the distribution, filling, import or supply of NG or LPG is to be reported by the conveyor for NG and the filler, importer or supplier for LPG
- dangerous gas fittings (as defined in RIDDOR) are to be reported by a "*member of a class of persons*".

3.2.16.3 Major injuries, death and dangerous occurrences are required to be notified immediately, for example by telephone, to the enforcing authority by the "*responsible person*" as defined by RIDDOR. Report can be made to the Incident Contact Centre:

- for fatal and major injuries only, telephone on 0845 300 9923 (opening hours Monday to Friday 8.30 am to 5 pm) and complete appropriate on-line form
- all other reports at HSE website www.hse.gov.uk

Complete the appropriate online report form listed below:

- report of an injury
- report of a dangerous occurrence
- report of an injury offshore

- report of a dangerous occurrence offshore
- report of a case of disease
- report of flammable gas incident
- report of a dangerous gas fitting.

The form will then be submitted directly to the RIDDOR database and a copy issued to the person making the report.

On-line written reports are to be submitted within the required timescale (10 days, or 14 days for dangerous gas fittings). Other reports are to be made as soon as practicable and within 10 days of the incident.

- 3.2.16.4 HSE website www.hse.gov.uk contains detailed guidance on RIDDOR, including a full list of injuries etc. that need reporting.

SECTION 4 : SELECTION OF APPLIANCES

- 4.1 Of the appliances covered by this Standard, new boilers with a normal operating temperature not exceeding 105 °C and other appliances fall within the scope of the European Gas Appliances Directive (GAD) implemented in the UK by the Gas Appliances (Safety) Regulations, which require such boilers and appliances to be CE marked. Those boilers with a heat output not exceeding 400 kW are also covered by the Boiler (Efficiency) Regulations.

New boilers with a maximum allowable temperature exceeding 110 °C are required to be CE marked in accordance with the Pressure Equipment Directive implemented in the UK by the Pressure Equipment Regulations. Boilers with a maximum operating temperature exceeding 105 °C, but a maximum allowable temperature not exceeding 110 °C, are subject, at least, to sound engineering practice in accordance with the Pressure Equipment Directive. Appliances outside the scope of GAD shall meet the requirements of the relevant product standard(s).

Note: In some cases, the requirements of IGE/UP/12 may also be relevant. Further information may be found in Non-domestic Building Services compliance code from Department of Communities and Local Government.

- 4.2 Where a burner is not supplied as an integral part of an appliance, the advice of the appliance and the burner manufacturers shall be sought and actioned with respect to the matching of the burner, appliance and chimney/flue system.

Note: Flame shape, burner head length and position, appliance resistance, etc. are typical characteristics that need to be verified.

SECTION 5 : LOCATION OF APPLIANCES AND PIPEWORK

5.1 GENERAL

5.1.1 The following is a typical list of information required during the planning stage for a new installation and upon which the necessary risk assessments shall be performed:

- the type of building into which the appliance(s) is to be installed. This may require information on the construction and suitability for the application
- applicable national and local legislation and by-laws
- the size and use of spaces designated for the location of appliances, gas pipework and chimney/flues
- the size, height and route of the chimney and flue and the position of its termination. Taking account of the consequences of local plumbing and methods of construction
- the provision of adequate air for combustion and ventilation, taking account of heat losses and gains in plant rooms
- gas pressure and the availability of existing or new supplies and their location
- the availability of electricity supplies and their location
- the location and routing of drains for condensate and boiler drains, together with any requirements for condensate and boiler water treatment
- the transmission of noise and vibration (information is available in CIBSE guide B2 and L108)
- any implications of hazardous areas upon the routing and installation of gas supplies together with the provision of ventilation (see IGEM/UP/16 and/or IGEM/SR/25).

Collaboration is essential throughout the project between all the parties concerned with design, installation, commissioning and operation of the completed gas system.

5.1.2 Appliances, pipework, controls and chimneys/flues shall be located in a safe and secure location and where they will not be damaged by other activities, for example the movement of fork lift trucks or cranes, chemical processes, or work with flammable products, for example on petrol tanks, etc.

Note 1: Further advice on car vehicle repair and body workshops is provided in IGEM/UP/18.

Note 2: The use of a purpose-built plant room for boiler installations is preferred.

5.1.3 Prior to the installation commencing, risk assessments shall be performed/reviewed to verify the suitability of the location of appliances, pipework, controls and chimneys/flues and if any additional safety measures are required.

5.1.4 Any appliance shall be located such that adequate space and safe access is available for initial installation, operation, commissioning and for subsequent maintenance of burners, controls, heat exchangers etc. Consideration shall also be given to the space and access required for replacement of major parts and the subsequent replacement of the appliance. Consideration shall be given to the means provided for safe access to combustion gas sampling points.

5.1.5 There shall be an adequate clearance between the appliance and its flue and any combustible materials. This information should be found in the manufacturers' instructions.

- 5.1.6 ➤ Appliances shall be located on suitable structures that can safely withstand their weight (including any water or thermal fluids) at a temperature specified by the appliance manufacturer.

For appliances containing liquids, the selected location shall, as necessary, incorporate means to safely drain and dispose of any liquids that might be released during maintenance, from leaks, due to condensation, from condensate etc. ◀

- 5.1.7 For boilers, adequate provision shall be made for the supply of water (treated where necessary) and the disposal of condensate and waste water.

- 5.1.8 Plant rooms and areas adjacent to appliances shall be kept free of combustible materials and of any obstructions which might interfere with safe maintenance and operation of the plant.

- 5.1.9 Any space containing a gas appliance must be constructed to comply with appropriate Building Regulations and with particular respect to satisfying the minimum provisions of the relevant parts of BS 476 in that:

- the load bearing elements of construction shall have a 30 minute load bearing capacity
- the construction shall have at least a 30 minute integrity
- any constructional insulation shall have at least a 30 minute performance.

Note: For further information, see Approved Document B of The Building Regulations for England and Wales, and The Building Standards (Scotland) Regulations, and Technical Booklet Part E for The Building Regulations (Northern Ireland), as appropriate.

- 5.1.10 Appliances fired by a heavier than air gas shall not be located in any space where all the walls are below ground level.

Note 1: This does not preclude the installation of such appliances into rooms which are low level with respect to one side of the building but open to ground level on the opposite side. In all cases, adequate low level ventilation to the outside is essential.

Note 2: For the purposes of this Standard, gas is heavier than air if it has a specific gravity (SG) exceeding 0.8 and lighter than air if it has an SG not exceeding 0.8.

- 5.1.11 Where an additional appliance is installed in the same area as other fuel-fired plant, or another air-consuming process, a risk assessment shall be made regarding the safety of the location.

- 5.1.12 The design and location of appliances and pipework shall not affect adversely the safety of persons or structures in the event of failure of any control system, loss of controlled fuel/air ratio or loss of containment of gas in the pipework system.

Note 1: A major gas leak could lead to a catastrophic failure of the plant room and to major physical damage to any building containing the plant room and to nearby buildings. Certain locations and plant constructions, for example basement plant rooms, fully enclosed reinforced concrete plant rooms, mid position plant rooms in high rise buildings, etc., require additional safety precautions.

Note 2: Precautions may include:

- use of high integrity pipework, all welded and inspected
- installing gas detection systems (see clause 9.1.1)
- ensuring secure ventilation with run and standby systems
- providing adequate explosion relief
- arranging daily visits by a person competent to carry out an inspection.

Before installation, an appropriate risk assessment to assess the need for any precautions shall be carried out by a suitably competent person.

5.1.13 Where a structure is designed to fail under a pressure build up, the relief shall be directed to a safe area and any relief panel shall be provided with an appropriate method of restraint to prevent injury to persons.

5.1.14 Appliances shall not be installed in any area that has been classified as a Zone 0 or Zone 1, nor should they be installed in any area that has been classified as a Zone 2 hazardous area unless the appliance(s), for example certain catalytic heaters or gas turbines, have been designed for that use and mitigating measures have been applied to ensure safety.

Note: Normally, correct hazardous area classification will result in the identification of distinct zones within spaces, for example Zone 0, 1, 2 or 2NE. Consequently, it is permissible to install appliances in areas such as Zone 2NE.

5.1.15 A safe exit route shall be provided for any plant room. The distance from any point in the plant room to the nearest point of access shall not exceed 12 m.

Note: The design of plant rooms needs to take into account adequate lighting and ease of escape in an emergency, such as siting of doors and their opening in the direction of the escape route. It is essential that any emergency door in the escape route can be opened without the use of keys (reference may also be made to BS 9999).

5.2 **RADIANT HEATERS**

5.2.1 Any heater shall be located at such a height that persons and materials will not be subject to excessive thermal radiation or temperature.

5.2.2 The maximum radiation levels at head height (nominally 2 m) should not be greater than 240 W m⁻² and, at floor level, should not be greater than 80 W m⁻².

5.2.3 Any heater shall be suitable for the conditions in which it is to be installed, particularly in corrosive and high-wind-speed environments.

Note: Alternative materials for finishes and manufacture may be necessary in corrosive environments.

5.2.4 Any means of suspension (wall or ceiling) shall be of sufficient number and strength to support the full weight of the heater and the unsupported part of its chimney/flue system. Such means of suspension shall be protected against corrosion.

5.3 **PRESENCE OF PETROLEUM AND OTHER HEAVIER THAN AIR FLAMMABLE VAPOURS**

5.3.1 Any appliance supplying air to a hazardous area shall be located either in the open air or in a separate room or compartment.

5.3.2 An appliance shall not be used to supply heated air to a hazardous area unless:

- all incoming air to the appliance is outside air and the outlets from ducts into the location are sited at least 1.8 m above the floor level
- the appliance has a full automatic and proven pre-purge and post-purge of the plenum chamber
- electrical apparatus, for example cables and switchgear, sited within 1.2 m of the floor level within the location, are protected appropriately.

Note: Further advice is provided in IGEN/UP/18.

5.4 **FINAL DESIGN DETAILS**

The design details including any risk assessments determining the safety of location, etc. shall be included in a technical file which shall be left with the responsible person on site, upon completion of the work.

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SECTION 6 : PIPEWORK

6.1 GAS PIPEWORK

6.1.1 Installation pipework shall be installed in accordance with IGEN/UP/2.

6.1.2 Pipework upstream of the burner shall be supported properly, making allowance for vibration and plant movement as appropriate.

6.1.3 A means shall be provided to manually isolate each appliance from the gas supply.

6.1.4 A single valve shall be provided and appropriately identified to isolate the gas supply to any group of appliances. This valve shall not replace the appliance isolation valve (see clause 6.1.3) and shall be separate from any automatic isolation valve (AIV) and be of the quick acting type, typically a 90° operation valve (see IGEN/UP/2).

Note 1: It is preferable for this valve to be located outside any plant room and it may be at a nearby meter installation. However, where the location is not secure from unauthorised interference, an automatic means of isolation can be used. For very large or high pressure installations, a fail-closed pneumatic valve may be appropriate.

Note 2: In the exceptional case where any existing downstream appliance is not fitted with a full flame detection system, a proving system is required in accordance with IGE/UP/12 or IGEN/UP/19.

6.1.5 Where MOP in the pipework to a plant room exceeds 1 bar, an AIV shall be fitted, outside the plant room or, if not practicable, near to the entry into the plant room.

When defined by a risk assessment, a vent or dump valve, downstream of the AIV and capable of reducing the gas pressure to below 500 mbar in the event of fire or other emergency, shall also be fitted.

If both an AIV and a vent or dump valve are installed, their operation shall be interlocked with position-proving switches to prevent inadvertent escape of gas caused by one valve failing open.

Any vent shall terminate in a well ventilated and safe location. Reference should be made to Sub-Section 9.2.

6.1.6 Where an AIV is fitted, if it can open automatically it shall comply with BS EN 161 Type A, B or C as appropriate. Where it is opened manually, it shall comply with the relevant requirements of BS EN 161. Appropriate filtration shall be installed if not integral with the valve.

6.1.7 There shall be incorporated means to carry out maintenance of all control valves, check meters and strainers/filters, for example by the use of additional valves.

6.1.8 In non-domestic buildings, energy metering should be provided to enable the owners/occupiers to control and compare energy consumption (see Part 1 of the Building Regulations, England and Wales or Building Control Scotland).

Note: This may be achieved by the use of gas check meters or heat meters.

6.1.9 Consideration shall be given to fitting a gas check meter, local to the plant, for example in those cases where the primary meter cannot be used for commissioning purposes.

Note: The installation of a check meter assists greatly the work of the commissioning engineer and is more important with larger, forced-draught burners. A check meter may be required to be installed by Building Regulations. The use of check meters may not be possible in all cases as their installation will increase the pressure drop in the system.

6.2 **GAS BOOSTERS, COMPRESSORS AND PRE-MIX MACHINES**

- 6.2.1 The installation of any gas booster, compressor or pre-mix machine system shall be in accordance with IGEN/UP/2 or IGEN/UP/6, as appropriate. Gas boosters with an outlet pressure not exceeding 150 mbar shall comply with BS 8487.

Note: The hazardous area considerations of booster shaft seals and flexible pipe connections need to be taken into account. See IGEN/UP/16 and the manufacturer's installation/maintenance instructions.

6.3 **AIR, OXYGEN AND OTHER EXTRANEIOUS GASES**

Where a burner is supplied with air, oxygen or any other extraneous gas under pressure, a means must be installed in the gas supply to each burner, group of burners, or the plant, to prevent the admission of the air, oxygen or other extraneous gas into any GT's network.

Note 1: This requirement can be met by the installation of a non-return valve (NRV) of a type acceptable to the gas supplier or GT.

Note 2: On plant where the only extraneous gas is air for combustion and each start gas and main flame is protected by a flame safeguard system and safety shut off valves (SSOVs) satisfying the requirements of BS EN 676 or BS 5885, there may be no need for a NRV. If in doubt, consult the gas supplier or GT.

Note 3: Further information is provided in IGE/UP/12.

6.4 **SUPPLY MOP**

Where MOP of pipework to an appliance exceeds the design pressure of the appliance, an additional regulator shall be fitted to that appliance.

Where failure of an upstream supply regulator will lead to an excess pressure at the appliance, an overpressure shut-off device or means of causing lockout of the appliance burner shall be fitted.

6.5 **ELECTRICAL INSTALLATION**

- 6.5.1 The electrical installation and its protective circuits shall be installed, inspected and tested in accordance with BS 7671. All electrical enclosures, components and cabling shall be suitable for the environment.

- 6.5.2 Ancillary components on the installation, for example an AIV or ventilation fan shall be suitable for the power supply voltage and frequency.

- 6.5.3 The electrical installation shall not restrict the withdrawal, opening or removal of appliance parts or casing for maintenance or replacement.

- 6.5.4 Means of local isolation of appliances shall be provided in an accessible position.

- 6.5.5 In multiple appliance installations, isolation of individual appliances shall not adversely affect the safety and operation of the remaining appliances, for example in hazardous areas and those affected by temperature, dust or humidity (see IGEN/UP/16 and IGEN/SR/25).

- 6.5.6 An electrical component requiring removal for maintenance shall be fitted with a means of disconnection such as a plug in an accessible position.

- 6.5.7 For wall hung boilers, switches and controls shall not be installed directly below the appliance.

- 6.5.8 Safety control(s) which are located remotely from the appliance and protect it from abnormal or potentially dangerous conditions, shall cause the appliance to shut down and require manual reset. In addition, a warning light or other signal shall operate until the condition has been rectified and the control reset.

6.6 **FINAL DESIGN DETAILS**

The design details, including any relevant risk assessments, sizing calculations for any pipework, valves, gas booster, safety components, etc. shall be included in a technical file which shall be left with the responsible person on site, upon completion of the work.

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SECTION 7 : VENTILATION

7.1 GENERAL

- 7.1.1 Adequate ventilation shall be provided to permit the safe operation of any appliance, including other fuel-fired appliances which may be affected by the installation of a gas appliance.

Note 1: The prescribed ventilation rates are based upon the total installed heat input of all fuel-fired heating appliances. It may be permissible for plant with a total connected load exceeding 1.8 MW net heat input, to design ventilation to match the design maximum load rather than the total installed heat input (see Appendix 7). Such a deviation has to be shown in the SDVN and the technical file that the ventilation is not designed for the installed plant (see clause 7.1.5).

Note 2: In this section the figure of 0.5 air changes per hour is specified. It would be unusual for an occupied space in which it is safe to work to have less air changes per hour.

Note 3: Many CHP packages require very high air flows for cooling and for combustion. It is recommended that, where practicable, the air supply and air extract system is separately ducted to CHP packages located within boiler plant rooms.



Note 4: The ventilation requirements in this Standard relate to the safe operation of appliances. Ventilation may also be needed under DSEAR for gas pipework see IGEN/UP/2 and IGEN/UP/11. In the majority of cases, this is provided by the appliance ventilation, however high level ventilation may always be required. ◀

The operation and maintenance of any combined heat and power (CHP) system in a plant room shall not lead to unsafe suction conditions.

- 7.1.2 For an open flued appliance, Type B, ventilation air normally shall be taken directly from outside. Only in exceptional circumstances may ventilation air be taken from inside, for example large well ventilated areas such as warehouses, etc. in which case a risk assessment shall be carried out to determine its suitability as a route for ventilation of open flued appliances. In cases where air is not taken directly from outside, a SDVN shall be issued by a competent person (see Appendix 6).

Consideration shall be given to the purpose of any internal space from which ventilation is provided. The internal space shall not be any part of a dwelling.

- 7.1.3 The design of air intakes shall be such as to prevent the ingress of rain, snow, leaves, debris, etc. The intakes shall be positioned at least 600 mm away from any obstruction.

- 7.1.4 The ventilation system shall be designed such as not to cause the installation space to be under suction to the extent that downdraught in the chimney system could lead to a reverse flow of combustion products into the room or into the appliance(s). In the unusual case for an existing boiler house where a suction exists, the safe operation of burners and appliances shall be verified during commissioning and subsequent servicing. In such cases, a SDVN shall be issued by a competent person (see Appendix 6).

- 7.1.5 The ventilation system shall take account of the heat losses from the installed equipment if the resultant rise in temperature could lead to failure of electrical components.

In addition, the ventilation system shall take into account any heat losses from electrical plant, such as electric motors. These shall be added to the rating of the gas-fired appliance(s) when determining ventilation rates or grille sizes.

- 7.1.6 The temperature within a plant room, enclosure or balanced compartment, assuming ambient air conditions of 15 °C, shall not exceed 25 °C within 100 mm of the floor, 32 °C at mid height and 40 °C within 100 mm of the ceiling.

The burner control system, electrical cables, electrical equipment, etc., within the installation space, shall not be exposed to temperatures above their design limits. Particular attention should be given to down-fired appliances in this respect (see Appendix 7).

Note 1: In some process areas, etc., ambient air temperatures and dust levels may be higher than normally experienced. In such cases, the manufacturer/supplier of the equipment and controls needs to be consulted.

Note 2: Where plant is used in the summer or with high ambient temperatures, the ventilation rate/grille sizes may need to be increased to limit the plant room temperature to 40 °C. In some cases, this may require mechanical ventilation.

Note 3: Where a plant room is occupied on a prolonged basis, high ambient temperatures will be unacceptable and additional ventilation may be needed to attain satisfactory working conditions.

Note 4: The reduction of solar gain through the plant room may also be effective in reducing elevated temperatures.

Note 5: As a guide, reduction of air temperature may be achieved by increasing the inlet and outlet air supply by 0.15 m³h⁻¹ or 0.2 cm² per kW of net heat input per °C of temperature reduction required. However, this will not be effective if ambient temperatures are high, in which case additional thermal insulation is the better option.

BS 6644 states in Commentary and Recommendations that, where appliances are to operate from 50% up to 75% of the time, an additional 1 cm² per kW at high and low level may limit the space temperature. Above this level, an additional 2 cm² per kW is recommended. See also Note 3 to Table 2 (page 29).

Where higher ventilation rates are applied in locations of cold winter conditions, consideration shall be given to the risk of freezing of water pipework, etc.

The design calculations for the ventilation system into any plant room shall form part of the technical file to be left on site with the plant. The file shall indicate:

- if the plant is intended for summer use
- the design heat emission into any plant room
- the ventilation grille sizes/mechanical flow rates
- the design plant room temperatures
- fuel type.

Where there is any deviation from IGEN/UP/10 requirements, a SDVN shall be issued by a competent person (see Appendix 6).

7.1.7 A single ventilation air duct or grille shall not serve as supply and extract unless subdivided throughout its complete route.

7.1.8 Ventilation air shall be taken from locations where it is not contaminated by dust, debris, noxious gas, propellants, etc. that might adversely affect safe operation of the appliances or the safety of persons.



Note: For ventilation of school buildings further guidance is provided by Guidance on ventilation, thermal comfort, and indoor air quality in schools DfE, previously Building Bulletin 101. ◀

7.2 **NATURAL VENTILATION – BOILERS, STORAGE WATER HEATERS AND THERMAL FLUID HEATERS**

Ventilation sizing is stated as "free open area" of the grille/vent.

7.2.1 **Open flued appliances, Type B in plant rooms**

7.2.1.1 The total area of ventilation shall be direct to outside air, provided via permanent openings sited so that they cannot be easily blocked or flooded (see also clause 7.1.2).

7.2.1.2 For an installation having a total net heat input exceeding 70 kW, the openings shall be as follows (see additional text in clause 7.2.1.3):

(a) At low level (inlet): 4 cm² per kW total net heat input.

(b) At high level (outlet): 2 cm² per kW total net heat input.

Note: For a lighter than air gas where the installation has a total net heat input exceeding 1.8 MW, where high and low level ventilation is not practicable, and the volume of the space is equal to or greater than 1 m³ per 2 kW total net heat input to the appliance(s), it is permitted to install 6 cm² per kW of total ventilation at high level only provided more than one ventilator is fitted. This is not permitted for a heavier than air gas.

For a lighter than air gas where the plant room does not exceed 1 m³ per 2 kW total net heat input, ducting of ventilation air to low level without mechanical assistance is not recommended (see Sub-Section 7.3).

7.2.1.3 Where bio-mass or solid fuel appliances are installed in the same space as a gas appliance, additional natural ventilation provision is often required to cater for higher excess air requirements of the biomass or solid flue appliance. Additional ventilation shall be provided at least 6 cm² per kW heat input low level and 3 cm² per kW heat input high level (approximately 8 cm² per kW low level and 4 cm² per kW high level based on heat output).

7.2.1.4 Calculations for air change rates shall include the air requirements for all process and combustion plant and persons.

7.2.1.5 High and low level ventilation shall be provided in the ratio 1 high level to 2 low level, that is 1/3rd at high, and 2/3rd at low, respectively on any one wall. As far as is practicable, the ventilation grilles shall be dispersed on more than one wall, maintaining the 1 to 2 ratio (see Figures 2 and 3).

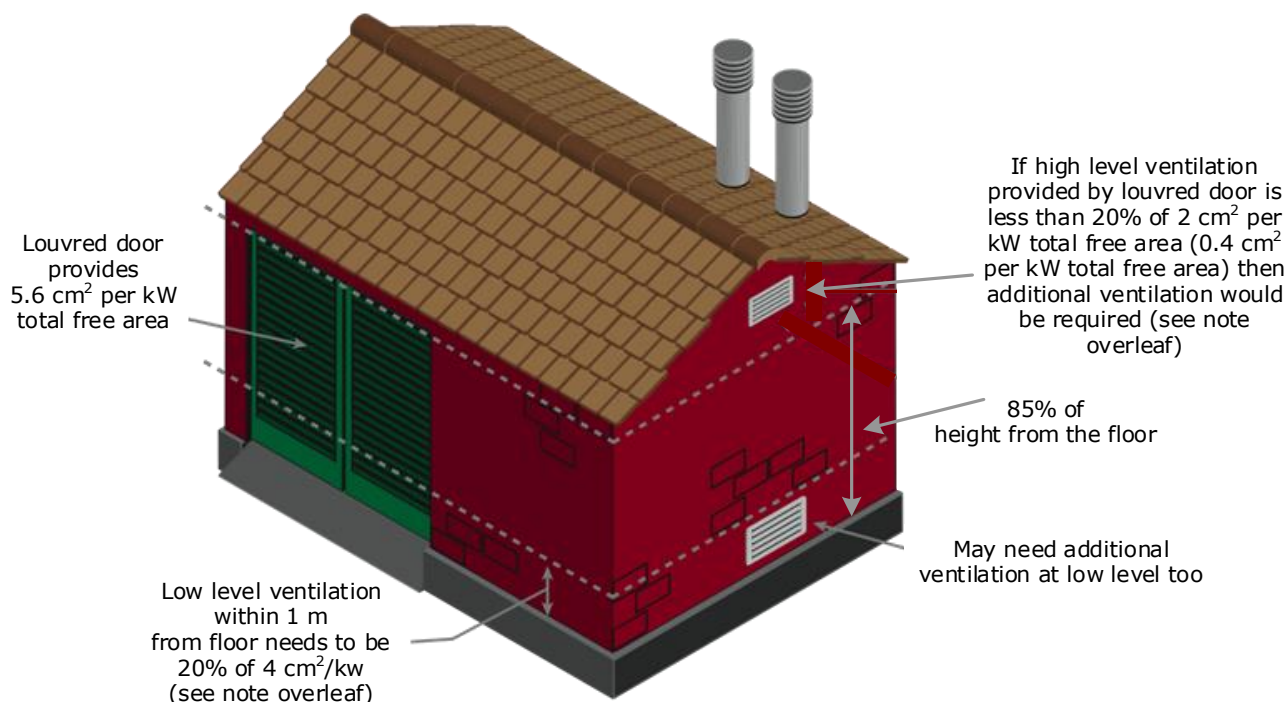


FIGURE 2 - EXAMPLE OF VENTILATION DISTRIBUTION FOR A PLANT ROOM WITH LOUVRED DOORS AND VENTILATION ◀.

Note: In this example, the louvred doors provide 5.6 cm² per kW. Low level ventilation is considered that within 1 m of the floor and if the free area in the louvred door is insufficient then additional ventilation will need to be added, preferably on another wall.

High level ventilation, 20% of 2 cm² per kW may need to be added and would be located within 15% of the height of the building from the highest point.

7.2.1.6 High level ventilation shall be provided as high as practicable.

Note: It is preferable for all or part of the ventilation openings to be within 15% of the room height from the ceiling.

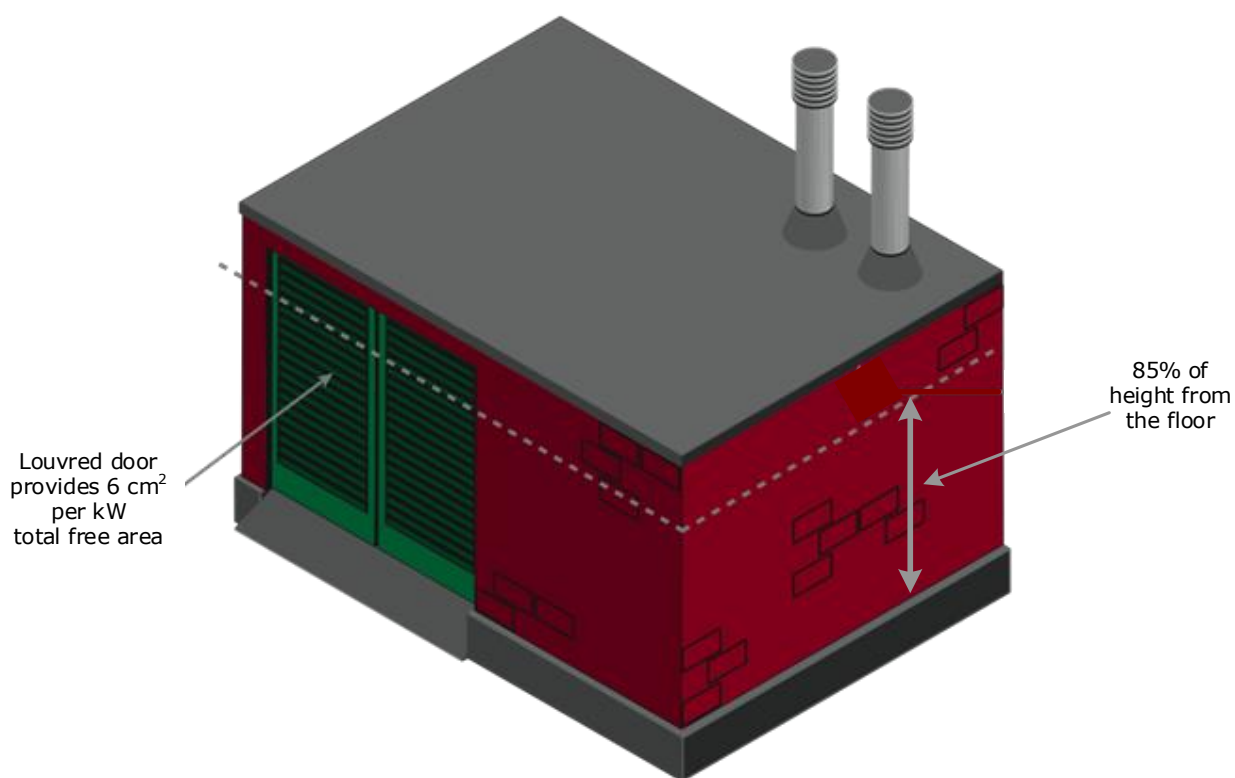


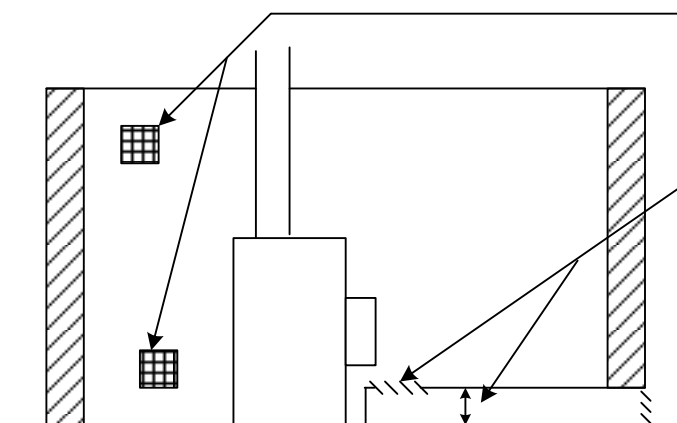
FIGURE 3 - EXAMPLE OF VENTILATION DISTRIBUTION FOR A PLANT ROOM WITH LOUVRED DOORS ONLY

- 7.2.1.7 Low level ventilation shall be provided as low as practicable and be within 1 m of the plant room floor for a lighter than air gas and within 250 mm of the floor for gases with an SG greater than 0.8.

Note: For gases with an SG above 0.8, it is preferred that low level ventilation is at floor level.

- 7.2.1.8 For a plant room, the high and low level ventilation shall be dispersed such that the ventilation is spread throughout the room to reflect the position of the appliance(s).

Note: Where combustion air is ducted towards, but not necessarily directly connected to, the burner, the low level ventilation can be calculated as 90% of the smallest cross sectional area (csa) of the duct or 90% of the smallest duct grille (inlet or outlet) free area, whichever is the smaller (see Figure 4).

Example:

Existing high and low external grilles provide a free area equal to 550 cm² compared to a calculated air requirement of 1000 cm².

The internal grille at the burner has a free area of 500 cm² and the supply duct has a csa of 450 cm², i.e. the duct area is smaller than the burner grille.

Take 90% of the smaller free area and subtract from the calculated air requirement:

$$\text{i.e. } 1000 - (0.9 \times 450) = 595 \text{ cm}^2.$$

This gives a shortfall of $595 - 550 = 45 \text{ cm}^2$ and the high and low grille area will need increasing proportionally by this amount.

Where air nearby is contaminated, clean air can be ducted from the outside as shown.

FIGURE 4 – EXAMPLE OF A PLANT ROOM WITH LOW LEVEL DUCTED AIR

7.2.2

Open flued (Type B) and room sealed (Type C) appliances in enclosures

The enclosure shall be provided with a minimum free open area of air grilles/vents in accordance with Table 1 (see also Sub-Section 7.1).

Note: It is important to note the definition of an enclosure (see Appendix 1).

The vertical distance between the high and low ventilation should be as great as is practicable.

FLUE TYPE	VENTILATION DIRECT TO OUTSIDE AIR (cm ² per kW net heat input)		VENTILATION TO AN INTERNAL SPACE (cm ² per kW net heat input)	
	HIGH	LOW	HIGH	LOW
OPEN (TYPE B)	5	10	Not permitted (see clause 7.1.2)	Not permitted (see clause 7.1.2)
ROOM SEALED (TYPE C)	5	5	10	10

Note 1: These ventilation requirements will be satisfactory provided that all heat-emitting surfaces such as hot pipes, chimneys or ducts are insulated adequately (see also Sub-Section 7.1).

Note 2: It is preferable that air is taken directly from outside.

TABLE 1 – MINIMUM VENTILATION OF ENCLOSURES

7.2.3

Open flued (Type B) appliances in balanced compartments

7.2.3.1

The design of the ventilation system shall ensure that the combustion system and discharge of combustion products operate correctly and safely and that surrounding plant room temperatures do not exceed those stipulated in clause 7.1.6.

7.2.3.2 Any door to a balanced compartment shall be self-closing, fitting tightly to the door frame and fitted with door seals. Such doors shall be fitted with a warning notice advising that they are to be kept closed.

7.2.3.3 Where a compartment is located internally within a building and any door opens into a habitable area, such a door must be self-closing and meet the requirements for fire resistance as given in the appropriate Building Regulations.

For an installation of total net heat input not exceeding 1.8 MW, any door opening into a habitable area shall be fitted with a switch to shut down the gas-fired plant when the door is opened.

Note: A time delay switch (delay up to 30 seconds) may be fitted to permit access. For an installation of total net heat input exceeding 1.8 MW, the same switch, with the same purpose, will need to be fitted unless determined otherwise by a risk assessment.

For a lighter than air gas, there shall not be any additional opening or window within the compartment.

For a heavier than air gas, any appliance shall be located against an outside wall and either:

- a means of low level ventilation shall be provided by the designer, or
- a minimum 60 cm² opening shall be provided at low level, direct to outside.

The designer shall verify that, if the balanced compartment has any additional ventilation provided at low level, the operation of the compartment is not affected adversely.

7.2.3.4 For an installation having a total net heat input exceeding 70 kW, the total area of high level openings into a compartment shall be a minimum of 10 cm² per kW total net heat input up to 500 kW. For a total net heat input exceeding 500 kW, any additional high level ventilation shall be a minimum of 8 cm² per kW total net heat input.

Note: For example, if there are four air handling ducts, each duct would be fitted with grilles of free surface area of a quarter of the value calculated above.

7.2.3.5 The ventilation openings shall be so positioned and protected as to prevent the ingress of rain, leaves and debris, and shall be positioned at least 600 mm from any obstruction to allow a free flow of air under all wind conditions.

7.2.3.6 The high level air handling duct shall be sub-divided to provide separation of the air supply and extract ventilation throughout its whole length.

The total csa of ducting connecting the balanced compartment to the terminal shall not be less than the free open area of the ventilation openings required by clause 7.2.3.4.

7.2.4 **Room sealed appliances in plant rooms, heated spaces and balanced compartments**

7.2.4.1 Ventilation shall take into account clauses 7.1.4, 7.1.6 and 7.2.3. Where a room sealed and an open flue appliance is to be installed in the same balanced compartment, 50% of the room sealed appliance total net heat input shall be added to the open flue appliance total heat input to obtain the ventilation requirements.

7.2.4.2 Room sealed appliances with an MOP not exceeding 100 mbar in ventilated spaces with an air change rate exceeding 0.5 air changes per hour do not require additional ventilation. If the air changes rate is below 0.5 per hour, 2 cm² kW⁻¹ ventilation at high and at low level shall be provided.

Note: This extra ventilation is required for pipework safety under the Dangerous Substances and Explosive Atmosphere Regulations (DSEAR) (see IGEN/UP/16).

7.3 MECHANICAL VENTILATION

Ventilation sizing is stated as "free open area" of the grille.

Where MOP of pipework within a plant room exceeds 100 mbar, failure of the mechanical fans may affect the risk assessment with respect to hazardous areas (see Sub-section 9.2).

- 7.3.1 The quantity of air and extract ventilation for plant of total net heat input exceeding 70 kW and not exceeding 1.8 MW shall be as given in Table 2. The quantity of air and extract ventilation shall at least be as given in Table 2 or the ventilation flow rate for the specific plant shall be calculated using an appropriate method. Where a bio-fuelled appliance is installed in the same space as a gas appliance, the additional mechanical ventilation provisions for that appliance shall be as per that of a gas fired appliance as detailed in Table 2.

Type of boiler/burner	Flow rate per kW (using total rated net heat input), m ³ h ⁻¹	
	Minimum supply air (combustion, ventilation)	Difference between supply and extract air (inlet minus extract ventilation)
Appliances with draught diverters	2.8	2.07 ± 0.18
Appliances without draught diverters with or without draught stabilisers	2.6	1.35 ± 0.18

TABLE 2 – MINIMUM QUANTITY OF MECHANICAL VENTILATION

Note 1: Where a supply air fan is used with natural extract ventilation, size the fan in accordance with Table 2, and size the extract grille at 2 cm² per kW total net heat input (see clause 7.2.1.2).

Note 2: In order to minimise the occurrence of negative pressures in plant rooms, designers need to maintain the difference between inlet and extract flow rates shown in Table 2, column 3.



Note 3: Where a boiler installation is occupied for example by boiler operators and is to operate in summer months, for example domestic hot water heating, the above allowance ought to be sufficient, provided that it does not operate for more than 50% of the time. If the boiler installation is to operate at a higher percentage of the time, increased ventilation will be required. For example, at 75%, an additional 720 m³ per hour per 1000 kW and, at 100%, an additional 1350 m³ per hour per 1000 kW total heat input will be required for inlet and extract air. ◀

Example calculation for fanned ventilation.

- Boiler capacity = 800 kW ◀.

From clause 7.3.1 Mechanical Ventilation Table 2

Assuming the appliances has draught diverters including stabilisers.

Min. supply ventilation volume would be;

$$2.8 \text{ m}^3 \text{ h}^{-1} \times 800 = 2240 \text{ m}^3 \text{ h}^{-1}$$

Difference between inlet/extract volumes is

$$2.07 \text{ m}^3 \text{ h}^{-1} \times 800 = 1656 \text{ m}^3 \text{ h}^{-1}$$

Actual extract volume would therefore be;

$$2240 - 1656 = 584 \text{ m}^3 \text{ h}^{-1}$$

The ventilation system shall be designed such as not to cause the installation space to be under suction to the extent that downdraught in the chimney system could lead to a reverse flow of combustion products into the room or into the appliance(s).

- 7.3.2 Extract only ventilation should be avoided, where practicable. There may be exceptional circumstances where it cannot be avoided. In such cases, it shall be demonstrated that no other options are available and that the safe operation of fuel fired appliances cannot be adversely affected. The operational data, including any specified flow rates/settings and interlock settings, shall be recorded in the technical file. A SDVN shall be completed (see clause 1.4).

Note: Examples may be very large plant rooms, which due to their location present problems or spaces where extract fans are necessary for environmental reasons.

In the unusual cases for an existing plant room where a suction exists (as may occur with fan diluted systems), the safe operation of burners and appliances shall be verified during commissioning and subsequent servicing. In such cases, a SDVN shall be issued by a competent person (see Appendix 6).

- 7.3.3 Fan operation shall be detected by power monitoring, air flow or pressure proving together with an auxiliary contact in the motor starter switch gear (where practicable) and be interlocked with appliance operation. Failure of either power/air flow/pressure proving or power to the motors shall shut down immediately the interlocked appliances/burners.

- 7.3.4 An air fan shall not be controlled by plant room temperature except following shut-down of the appliance(s) caused by clock or space/process controls.

Note: After shut-down of the plant, the fan(s) may be needed for cooling to satisfy clause 7.1.4.

- 7.3.5 Ductwork and grilles shall be constructed of fit-for-purpose materials which are non-combustible, corrosion resistant and have appropriate resistance to fire and the spread of fire. Jointing methods shall be asbestos-free, durable and non-combustible.

7.4 VENTILATION – OVERHEAD RADIANT HEATERS

7.4.1 General

In buildings having a design air change rate of less than 0.5 air changes per hour, clauses 7.4.2.2 or 7.4.2.3, as appropriate, shall be applied.

Note 1: In buildings with a design air change rate of 0.5 air changes per hour or greater, additional natural or mechanical ventilation may not be necessary.

Note 2: It is important that reference be made to the detailed requirements for the installation of overhead radiant heaters given in BS 6896.

7.4.2 Type B₁ heaters, type B₂ heaters and type B₂ multi-burner systems

7.4.2.1 Natural ventilation

Ventilation openings with a free area of at least 2 cm² per kW of net heat input shall be provided at low level, that is below the level of the heater flue connection, for both Type B₁ heaters (which have draught diverters) and Type B₂ heaters (which do not have draught diverters).

Any air vent communicating with outside air shall be sited such that there is an adequate separation between the air vent and any part of a heater flue terminal (to minimize the risk of re-entry of the products of combustion).