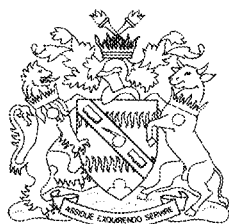


***IGEM/G/5 Edition 2
Communication 1762***

Gas in multi-occupancy buildings

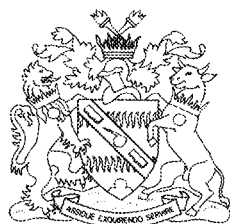


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Royal Charter 1929
Patron: Her Majesty the Queen*



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Communication 1762***

Gas in multi-occupancy buildings



Price Code: C5H
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ISBN 978 1 905903 37 5
ISSN 0367 7850

Published by the Institution of Gas Engineers and Managers

Previous Publications:
Communication 1712 (2006) - 1st Edition

For information on other IGEM Standards visit our website, www.igem.org.uk

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SECTION 1 : INTRODUCTION

- 1.1 This Standard has been drafted by a Panel appointed by the Institution of Gas Engineers and Managers' (IGEM's) Technical Co-ordinating Committee, subsequently approved by that Committee; the Gas Utilization Committee, the Gas Measurement Committee and the Gas Transmission and Distribution Committee, and published by the authority of the Council of IGEM.
- 1.2 This Standard summarises best practice for the design, installation, operation and maintenance of gas installations for multi-occupancy buildings (see Sub-Section 2.1). It combines well established practices with new advice on aspects of design and construction of such installations. The Standard consolidates best practice and guidance from legislation, and existing gas industry standards and procedures, with the aim of helping to achieve safe designs and installations for gas in the buildings concerned.
- 1.3 Significant amendments have been made compared to the first Edition. These include:
- reviewed hierarchy for timber and traditionally constructed buildings
 - revision of all Figures and new additional Figures
 - reviewed location of electrical insulation fittings/couplings
 - updated requirements for equipotential bonding
 - additional requirements for isolation valves
 - further emphasis with respect to gaining access to network pipelines for future maintenance
 - requirements for energy centres
 - new procedure for testing existing network pipelines.
- 1.4 This Standard makes use of the terms "must", "shall" and "should", when prescribing particular procedures. Notwithstanding Sub-Section 1.7:
- the term "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.

- 1.5 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 primary responsibilities. Employers must:
- have done everything to ensure, so 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 by "responsible engineers"
 - 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 that deviate from this, they should refer the matter for higher review.
- 1.6 It is now widely accepted that the majority of accidents in industry generally 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 the HSG48 and HSG65.
- 1.7 Notwithstanding Sub-Section 1.4, this Standard does not attempt to make the 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 IGEM's Journal and other publications as appropriate.
- 1.8 Requests for interpretation of this Standard in relation to matters within its scope, but not precisely covered by the current text, should be addressed to Technical Services, IGEM, IGEM House, High Street, Kegworth, Derbyshire, DE74 2DA, 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 IGEM, this does not relieve the responsible engineer of any of his or her obligations.
- 1.9 This Standard was published in September 2012.

SECTION 2 : SCOPE

- 2.1 This Standard covers gas installations to and within multi-occupancy buildings and the individual dwellings and commercial units within such buildings.

Note 1: The term "multi-occupancy building" means a building that contains multiple domestic dwellings or a building that contains both multiple domestic dwellings and commercial units.

Note 2: The term "dwelling(s)" means both "domestic dwelling(s)" and "commercial unit(s)" within a multi-occupancy building, unless otherwise stated.

Note 3: Properties deemed separate buildings, each comprising an individual single dwelling, such as detached, semi-detached or terraced houses/bungalows, are not covered.

Note 4: The principles of this Standard may be applied to buildings containing only commercial units.

- 2.2 This Standard covers new and replacement gas network pipelines, meter installations, installation pipework (including secondary meters), appliances and chimneys.

Note 1: In this context, "new and replacement" embraces:

- any first time gas supply or replacement of any of the above mentioned sections of the gas supply system
- any new extension to an existing section of the gas supply system
- significant partial replacement of/alteration to any of the sections of the gas supply system. For example, the replacement of a riser system having one or more laterals connected would likely be deemed 'significant partial replacement'.

Regarding replacement/alteration, it is important to comply with legal obligations, for example, the checks required by Gas Safety (Installation & Use) Regulations (GS(I&U)R) following work on any part of a gas supply system.

Note 2: Requirements for maintenance are provided in Section 13.

Note 3: A network pipeline supplying a primary meter installation will be a "service" or a "distribution main". The difference, for the purposes of this Standard, is insignificant except when cross referring to other Standards, for example IGE/TD/3 and IGE/TD/4. This Standard uses either or both of the terms "network" or "pipeline" throughout.

Note 4: IGE/TD/3 does not address pipes in buildings. IGE/TD/4 references IGEM/G/5 with respect to gas in multi-occupancy buildings.

- 2.3 For the replacement of existing installations and like-for-like component replacement and where reasonably practicable, IGEM would expect adoption of this Standard. In any event IGEM would expect a risk assessment (see Sub-Section 4.2) to be carried out and appropriate mitigation actioned where indicated by the risk assessment.

2.4 This Standard defines requirements covering the core areas of safety for gas in multi-occupancy buildings, such as:

- planning, risk assessment and minimising risk
- meter installations and location of gas meters with respect to escape routes and the GS(I&U)R and Building Regulations

Note: This significantly affects many other aspects of the installation, for example ventilation, consumer access for meter reading and isolation, and escape routes.

- network pipelines, types of building entry, risers, laterals and isolation valves
- ventilation of network pipelines, meter installations and installation pipework
- access for inspection and maintenance to network pipelines, meters, installation pipework and appliance chimneys
- modifications, repairs, testing and re-commissioning of existing network pipelines
- energy centres and their risks in relation to domestic dwellings and their occupants
- installation pipework, gas appliances and chimneys
- materials
- location of valves
- electrical safety and equipotential bonding

Note: The text on this subject has been drawn up with the assistance of the Institution of Engineering Technology (IET) and the Energy Networks Association (ENA).

- responsibilities and competence.

Note: This Standard includes requirements that are either additional to or vary existing requirements contained in other standards where the requirements of those other standards may not be sufficient for gas installations in multi-occupancy buildings. However, those existing Standards are referenced and the majority of their requirements will still apply where relevant. These standards include:

IGEM/TD/3 and IGE/TD/4 for network pipelines; IGE/TD/13 for pressure regulating installations (PRIs); BS 6400 for domestic-sized meter installations; IGE/GM/6 and IGE/GM/8 for larger meter installations; IGE/GM/7A and IGE/GM/7B for electrical connections to, and hazardous area classification of, meter installations; BS 6891 for domestic-sized installation pipework; IGE/UP/2 for larger installation pipework; IGE/UP/7 for timber and light steel framed buildings; BS 5440-1 and 2 for the supply of chimneys and ventilation; IGE/UP/17 for dealing with shared chimney and flue systems.

2.5 This Standard addresses requirements for the risk assessment of gas installations within any multi-occupancy building and the individual dwelling(s)/unit(s) within such a building.

2.6 This Standard generally addresses appliances within domestic dwellings or commercial units having a heat input not exceeding 70 kW based on net calorific value (CV), which have been CE marked.

This Standard covers all types of open flue chimney or room sealed chimney systems (that comply with appropriate construction standards) for gas appliances, whether they are separate from, or integral with, the appliances.

- 2.7 This Standard addresses gas installations intended to contain odourised Natural Gas at a network maximum operating pressure (MOP) not exceeding 75 mbar within an occupied building.
- Note 1: Where the network MOP exceeds 75 mbar, a PRI has to be installed in the network pipeline in accordance with IGE/TD/13 or the primary meter installation has to be in accordance with BS 6400-2 or IGE/GM/8, as appropriate. Any such PRI or meter installation has to be located outside the building or in a separate compound/enclosure sealed from the building and accessible only from the outside.*
- Note 2: This Standard assumes a gas supply layout as given in IGE/G/1 for "Standard gas supply arrangements". Where a "bulk meter" serves secondary meters, via installation pipework, the principles of IGE/UP/2 also may be applicable.*
- Note 3: For energy centre installations, see Section 8.*
- 2.8 The term "meter" means "gas meter" unless otherwise stated.
- 2.9 The term "GT" is deemed to include a "Gas Conveyor" conveying gas in a network pipeline.
- Note: The definition of "Gas Conveyor" is given in IGE/G/1 and IGE/G/4.*
- 2.10 All pressures quoted are gauge pressures, unless otherwise stated.
- 2.11 Italicised text is informative and does not represent formal requirements.
- 2.12 Appendices are informative and do not represent formal requirements unless specifically referenced in the main sections via the prescriptive terms "must", "shall" or "should".

SECTION 3 : LEGISLATION, RESPONSIBILITIES, STANDARDS AND COMPETENCY

3.1 GENERAL

- 3.1.1 This Standard is set out against a background of legislation in force in GB at the time of publication. Similar considerations are likely to apply in other countries and reference to appropriate national legislation will be necessary.

Appendix 2 lists legislation, guidance notes and standards etc. which are identified within this Standard as well as further items of legislation 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.

- 3.1.2 Health and safety legislation must be observed, including those requirements concerned with the duties of employers towards both their employees and other persons, including members of the public whose safety may be affected.

In the absence of specific legislation, it is essential that installations are designed, constructed, installed, operated and maintained so as to be safe.

3.2 LEGISLATION

3.2.1 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.

3.2.2 Management of Health and Safety at Work Regulations (MHSWR)

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.

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

- 3.2.3.1 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).

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

- 3.2.3.3 GS(I&U)R defines the type of work that requires persons carrying out such work, or their employers, to be a "member of a class of persons". In United Kingdom, Northern Ireland, the Isle of Man and the Channel Islands this means registration under the Gas Safe Register scheme.

- 3.2.3.4 The installer must 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/hirer has special responsibilities to ensure that

any installer they use for gas fitting, service, maintenance or safety is an approved class of person if applicable (see Sub-Section 3.3) and is competent to carry out such work. If any serious fault is found, the installer must inform both the landlord/hirer, as well as the user, so that such faults can be rectified before further use. Reference should also be made to the current "Gas Industry Unsafe Situations Procedures" as issued by Gas Safe Register.

Note: HSL56 is an Approved Code of Practice (ACoP) and Guidance on GS(I&U)R.

- 3.2.3.5 Landlords must ensure that annual safety checks are carried on appliances/flues and that a record is kept and issued (or in certain cases, displayed) to tenants. In addition, landlords must ensure any necessary inspection and maintenance of associated installation pipework is carried out.

3.2.4 **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.

The Regulations 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.

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

Note 1: HSR25 gives guidance on the Regulations.

Note 2: Organisations that operate approved competent person self-certification schemes for any electrical work at the time of publication of IGEN/G/5 Edition 2 are: BESCA, BSI, ELECSA, NAPIT and NICEIC.

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

CDM apply to almost all construction work and impose duties on designers, clients, developers and contractors. The client must appoint a CDM co-ordinator and principal contractor, who must be in place throughout the construction phase. Not all the Regulations apply to all construction projects, further information is given in HSL144. For a notifiable project (as defined in CDM) the CDM Co-ordinator must notify HSE before construction work commences. Construction includes the alterations, repair, redecoration, maintenance, decommissioning and demolition of a structure. It also covers installation, commissioning, maintenance or removal of gas services.

Note: HSL144 is an ACoP and guidance on CDM.

3.2.6 **Pipelines Safety Regulations (PSR)**

PSR provide a means of securing pipeline integrity by ensuring that a pipeline is designed, constructed and operated safely. PSR apply to all network pipes operated by a gas transporter (GT). Installations can vary in size and complexity, and installation designers have to give due consideration to the operating pressure (OP) and required gas flows.

Note: HSL81 and HSL82 give guidance on PSR.

In particular, PSR require that the operator ensures no fluid is conveyed in a pipeline unless the pipeline has been designed so that, as far as is reasonably practicable, examination and maintenance may be carried out safely. PSR also require that the operator ensures that a pipeline is maintained in an efficient state, in efficient order and in good repair.

Note 1: Regulation 5 of the PSR requires the operator and therefore the designer to ensure "...that no fluid is conveyed in a pipeline unless it has been so designed that, so far as is reasonably practicable, it can withstand-

(a) forces arising from its operation;

(b) the fluids that may be conveyed in it; and

(c) the external forces and the chemical processes to which it may be subjected."

Note 2: These requirements are likely to be significant to a GT considering whether to adopt a network pipeline extension for which the key consideration is fitness-for-purpose of the pipeline and access for future inspection and maintenance.

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

The aim of PSSR is to prevent serious injury from the hazards of stored energy as a result of failure of a pressure system or one of its component parts. With the exception of steam, PSSR do not consider the hazardous properties of the contents released following system failure. PSSR do not apply to the installations within main buildings covered by this Standard but may apply to such as network pipelines and PRIs external to the building.

Note: HSL122 is an ACoP on PSSR.

3.2.8 **Building Regulations and Standards**

Although many of the requirements of the Building Regulations (England and Wales), the Buildings (Scotland) Regulations and Building (Amendment) Regulations (Northern Ireland) are similar, they sometimes differ in specific detail. The designer must refer to the appropriate Regulations for the country concerned.

3.2.8.1 *England and Wales (as Amended)*

3.2.8.1.1 Building Regulations are Statutory Instruments that must 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.

3.2.8.1.2 The Approved Documents that apply to gas work are:

- A (Structure)
- B (Safety in Fire)
- F (Ventilation)
- G (Hygiene)
- J (Heat producing Appliances)
- L (Conservation of Fuel and Power)
- M (Access to and use of buildings)
- P (Electrical Safety).

Note 1: Further information is available from the Department for Communities and Local Government website.

Note 2: From 31st December 2011, the power to make changes to the Building Regulations for Wales has been passed to Welsh Government. At the time of publication, the Department of Communities and Local Government is reviewing the Building Regulations for England. Therefore reference needs be made to correct Regulations for the appropriate territory.

3.2.8.2 *Building Standards (Scotland) Regulations and Amendments*

3.2.8.2.1 The Building Standards (Scotland) are written directly as Regulations within the Statutory Instrument. The Regulations can be satisfied:

- by compliance with Technical Standards published by the Scottish Office

Note: The technical handbooks are available through the Scottish Government's website.

- conforming with the provisions of "deemed to satisfy" documents, for example British Standards
- other equivalent means.

3.2.8.3 *Northern Ireland (as amended)*

3.2.8.3.1 The Regulations can be satisfied:

- by compliance with Technical Standards
- conforming with the provisions of "deemed to satisfy" documents, for example British Standards
- other equivalent means.

Note: Further information is available from the Department of Finance and Personnel website.

3.2.8.4 *Building Regulations for the Isle of Man*

These are statutory Regulations made by the Isle of Man Government.

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

DSEAR apply to any workplace where there is present any substance or mixture of substances with the potential to create a risk from energetic (energy-releasing) events such as fire, explosions, etc. Such substances, known in DSEAR as dangerous substances, include NG. Installation of appliances manufactured to the Gas Appliances (Safety) Regulations is excluded from DSEAR, as is a "gas fitting" within the meaning of GS(I&U)R, at domestic premises. However, network pipes are not such gas fittings and any work carried out in domestic premises when network pipes contain gas is subject to DSEAR.

The following contain details of DSEAR and their application:

- HSL134
- HSL135
- HSL136
- HSL137
- HSL138
- INDG 370.

DSEAR require relevant pipes to be labelled, for example to indicate they contain gas.

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

GS(M)R place specific duties on GTs, or their emergency service providers (ESPs), for dealing with gas escapes from pipes on their network. The primary duty is to make the situation safe. GTs 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 **Gas Act**

The safe construction of a pipeline is an activity which a GT is entitled to undertake under the Gas Act 1986 as amended by the Gas Act 1995 and incorporating standalone provisions of the Utilities Act 2000.

The Gas Act enables the Secretary of State to make Regulations empowering authorised personnel to enter premises to inspect pipes, fittings, appliances and chimneys and to take action necessary to protect life and property.

3.2.12 **Rights of Entry (Gas and Electricity Boards) Act**

This Act restricts the exercising of rights of entry. No right of entry shall be exercisable in respect of any premises except:

- with consent given by or on behalf of the occupier of the premises, or
- under the authority of a warrant

unless entry is required in a case of emergency.

3.2.13 **Gas Safety (Rights of Entry) Regulations 1996**

These Regulations provide the legal framework for the application of the Gas Industry Unsafe Situations Procedures.

In addition these Regulations confer rights of entry upon "gas transporters" and "relevant authorities" to enter premises for the purpose of preventing gas escapes, the examination and disconnection of "gas fittings" and other related purposes.

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

3.2.14.1 Work equipment has a wide meaning and includes tools such as hammers, pipe clamps for example ladders, lifting equipment and machinery for use at work.

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

3.2.14.3 More information on the Regulations can be found in HSL22. Free leaflets include INDG291 and INDG229.

3.2.15 **Regulatory Reform (Fire Safety) Order**

3.2.15.1 The Order applies in England and Wales to non-domestic properties, including common areas of multi-occupancy buildings.

Note 1: In Northern Ireland and Scotland compliance is with the Fire Safety Regulations (Northern Ireland) and the Fire Safety (Scotland) Regulations respectively.

Note 2: Reference may need to be made to the Housing Act for multi-occupancy buildings containing domestic dwellings.

3.2.15.2 The Order made a number of changes to the previous legislation such as the Fire Precautions Act. It shifts the emphasis towards preventing fires and reducing risk, with the aim of reducing deaths, injuries and damage caused by fire.

The Order removes the obligation to have fire certificates with any existing fire certificates no longer having legal status. It places duties on a 'responsible person' to ensure compliance with the Order. A 'responsible person' is any person who has control over a building which normally rests with the employer.

The Order requires a fire risk assessment to be carried from which the findings must be acted upon.

Note: Guides for a range of premises is available from the Department for Communities and Local Government website.

3.2.16 Work at Height Regulations

3.2.16.1 These Regulations apply to all work at height where there is a risk of a fall liable to cause personal injury. In the context of this standard the Regulations are particularly relevant to the installation, inspection and maintenance of external risers.

Note: Further information can be found in HSE Leaflet INDG 401.

3.3 RESPONSIBILITIES

Responsibilities for the installation and operation of sections of the gas supply system are shown in Table 1.

DESCRIPTION (see Figures 1 to 6)	RESPONSIBILITY
Network, including the emergency control valve (ECV) and any PRI upstream of the ECV	GT
Primary meter installation	Meter owner (for example Gas Supplier or GT) <i>Note 1: The GT has responsibility for pressure control in all cases, and others have to request permission from the GT to break a seal, set and seal a meter regulator.</i> <i>Note 2: The meter owner may use a Meter Asset Manager (MAM) to carry out its obligations.</i>
Installation pipework (including secondary and sub-deduct meter installations)	Pipework owner (for example the occupier, landlord/housing association)
Appliance connector and appliance	Appliance owner (for example the occupier, landlord/housing association)
Ventilation of ducts, meters etc.	Building owner

Note 1: An emergency control is defined by Regulation 2 of GS(I&U)R as "a valve for shutting off the supply of gas in an emergency, being a valve intended for use by a consumer of gas". The more commonly used term, emergency control valve (ECV), is used in this Standard. The outlet of the ECV denotes the end of the network. The term "consumer of gas" is taken to mean the person who uses the gas for heating, cooking, etc., i.e. the occupier of a dwelling. It follows that an ECV has to be readily accessible at all times to this consumer.

Note 2: Normally, the ECV is positioned at the inlet to the primary meter, either inside the dwelling itself or in a separate meter box/cupboard/room. However, frequently, there will be an additional valve (the inlet isolation valve (IIV)), near to the point where a network pipeline enters a building. This additional valve is often designated as being for use by someone other than the consumer, for example the GT, landlord or emergency services. This valve is not an ECV as defined and, therefore, it may be in a locked room etc. which is inaccessible to the building occupants.

Note 3: Where a valve is intended for use by consumers of gas for shutting off the supply of gas in an emergency, for example the valve on the inlet of a primary meter supplying gas to downstream secondary meters, it would meet the definition of an ECV and has to be made readily accessible to all consumers.

Further guidance is given in IGEN/G/1 and HSL56.

TABLE 1 - RESPONSIBILITIES FOR INSTALLATION AND OPERATION

3.4












TYPICAL INSTALLATIONS

With respect to requirements for emergency controls, compliance with PSR, GS(M)R and GS(I&U)R must be ensured.

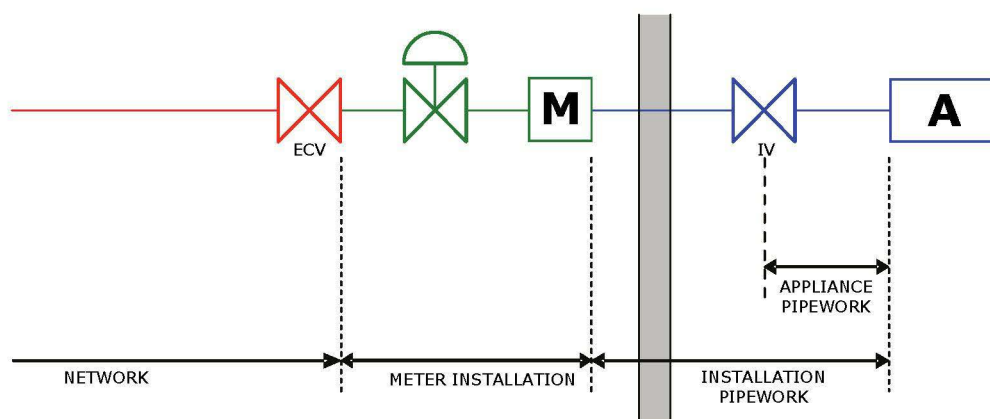
The following diagrams represent typical arrangements for network pipelines, valves, regulators, meters, installation pipework and appliances. They show typical installations that may be derived from the "Standard gas supply arrangements" as described in IGEM/G/1.

The diagrams are schematic only and do not purport to show all required detail. For example, required ventilation is not shown.

Key to Figures 1 to 6

	valve (part of the network)	AECV	additional emergency control valve
	valve (part of installation pipework)	ECV	emergency control valve
	regulator	IIV	inlet isolation valve
	regulator	IV	isolation valve
	primary meter	PIV	pipeline isolation valve
	secondary meter		network
	appliance		meter installation
	building wall		installation pipework

Note: IGEM/G/1 uses the terms "service isolation valve (SIV)" and "distribution main isolation valve (DMIV)". The term "pipeline isolation valve", embraces both SIV and DMIV.



Note: If the meter installation is not adjacent to, and hence not easily accessible from, the individual dwelling it supplies, an AECV has to be installed as indicated in Figure 5.

FIGURE 1 - TYPICAL EXTERNAL METER INSTALLATION ADJACENT TO AN INDIVIDUAL DWELLING

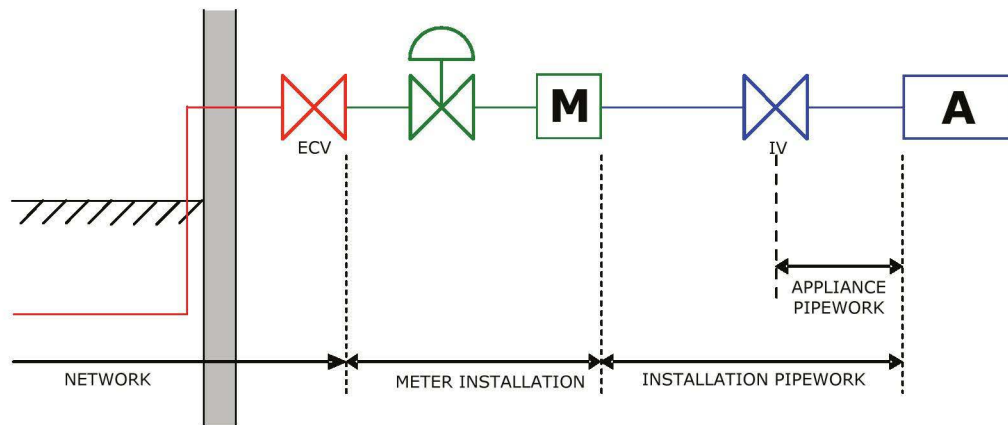


FIGURE 2 - TYPICAL INTERNAL METER INSTALLATION WITH ECV WITHIN AN INDIVIDUAL DWELLING. NETWORK PIPELINE HAVING ABOVE-GROUND ENTRY

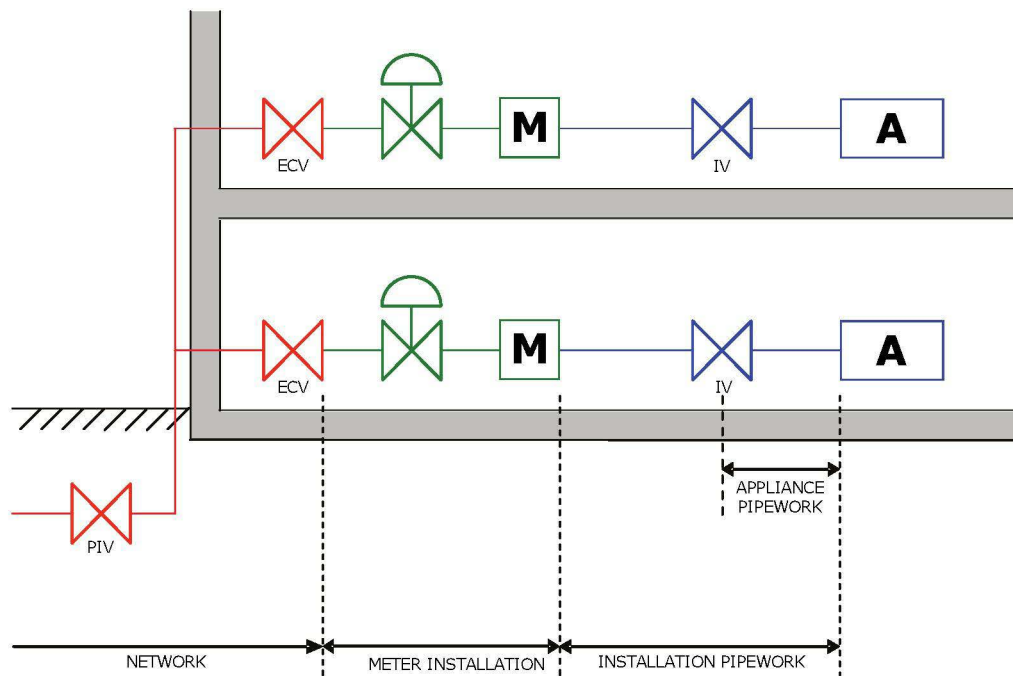


FIGURE 3 - TYPICAL INTERNAL METER INSTALLATIONS WITH ECVs WITHIN INDIVIDUAL DWELLINGS. EXTERNAL NETWORK RISER

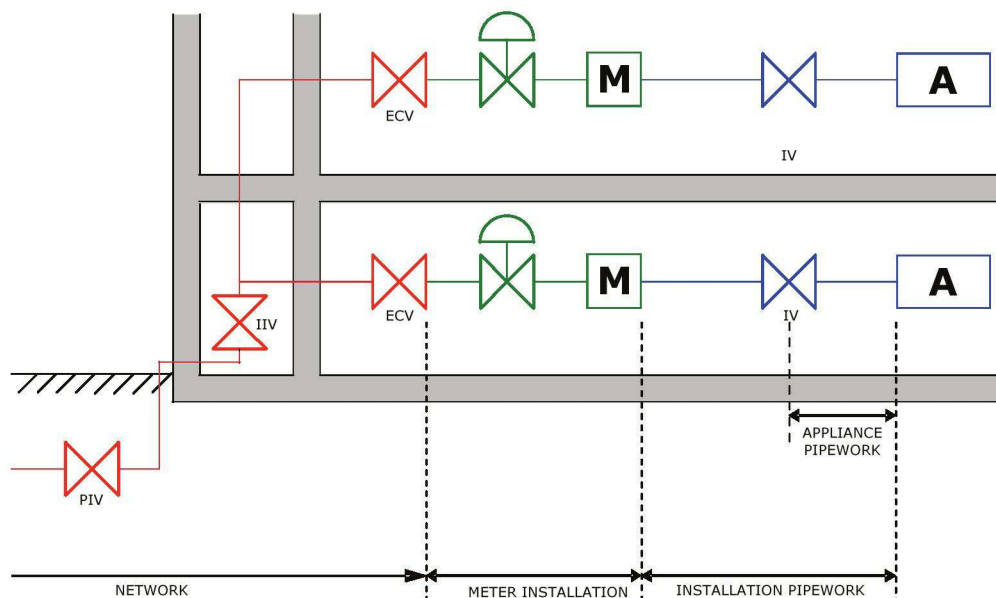
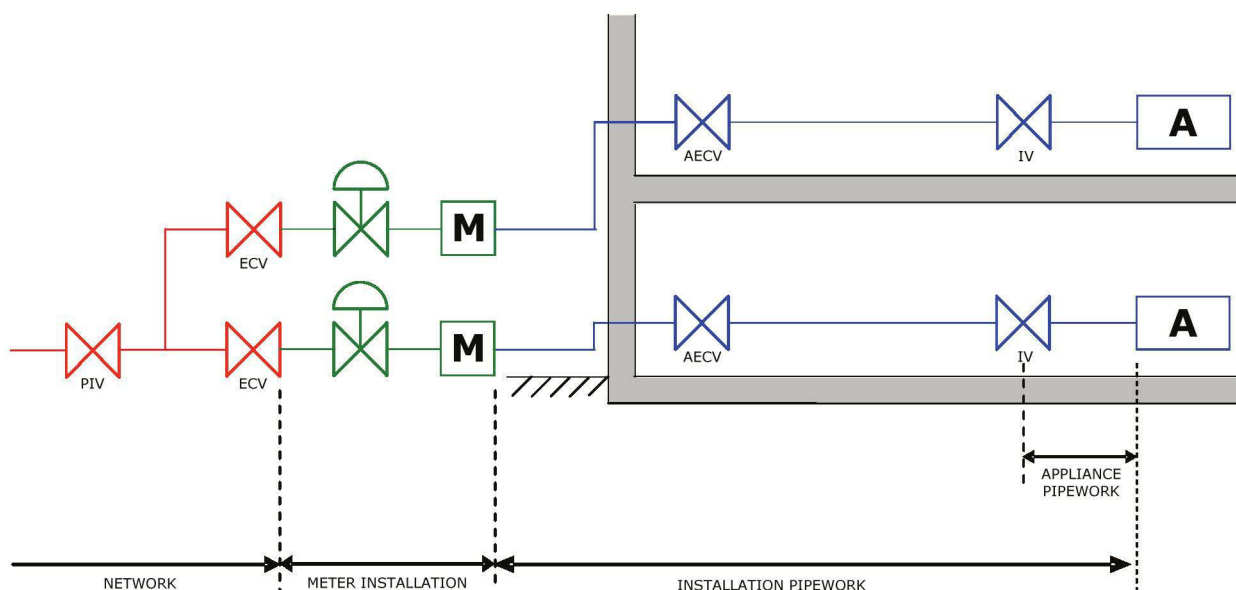
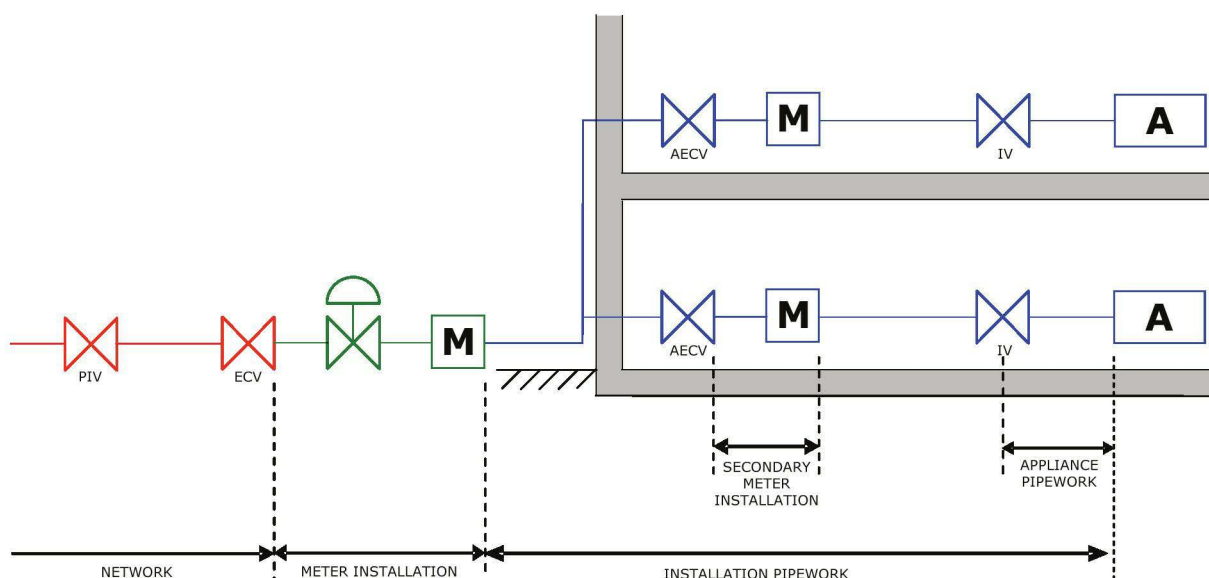


FIGURE 4 - TYPICAL INTERNAL METER INSTALLATIONS WITH ECVs WITHIN INDIVIDUAL DWELLINGS. INTERNAL NETWORK RISER



Note: Remote meters and ECVs may also be located within the building, for example in a dedicated meter room, but an IIV may then be required.

FIGURE 5 - TYPICAL REMOTE METERS AND ECVs. AECVs FITTED WITHIN INDIVIDUAL DWELLINGS



Note 1: See also Notes to Sub-Section 3.3 with respect to the ECV.

Note 2: This design would also apply for AECVs where there is no secondary metering.

Note 3: The primary meter installation may also be located within the building, for example in a meter room.

Note 4: Additional requirements for primary/secondary meter installations in a building are contained in GS(I&U)R, Regulations 16(1) and 17.

FIGURE 6 - TYPICAL REMOTE BULK METER. AECVs AND SECONDARY METERS WITHIN INDIVIDUAL DWELLINGS

3.5 COMPETENCY

3.5.1 General

3.5.1.1 Any person who designs a gas installation shall have sufficient knowledge and understanding of the Regulations and Standards that apply to ensure that the completed plans will produce a safe and satisfactory installation.

3.5.1.2 Any person installing, inspecting or maintaining gas pipework and associated fittings must be competent to do so.

Note: The definition of a competent person is given in IGEM/G/4.

3.5.1.3 Where gas installation work is carried out on pipework in properties covered by GS(I&U)R, the person carrying out that work must be a "member of a class of persons" as specified by GS(I&U)R.

Note: For the purposes of this Standard, GS(I&U)R covers any component downstream of the ECV and contains requirements for the ECV itself (see also the Note 1 to clause 3.5.1.4).

Persons who are deemed competent to carry out gas work under GS(I&U)R are those who hold a current certificate of gas safety competence in the appropriate categories of work acceptable to Gas Safe Register which includes (without limitation) the Accredited Certification Scheme (ACS) and/or the Gas Services S/NVQ that has been aligned to ACS.

- 3.5.1.4 Where work not covered by GS(I&U)R, but covered by PSR, is carried out, the adopting GT must be satisfied that the installer is competent to do such work.

Note 1: For the purposes of this Standard, PSR cover any component upstream of, and including, the ECV.

Note 2: For work not covered under GS(I&U)R, useful guidance on core criteria for demonstration of competence is given in Appendices 4 and 5 of the HSL144.

3.5.2 Welding

- 3.5.2.1 Any welder shall possess an appropriate certificate of competency demonstrating that they have carried out welder approval tests and selected the appropriate fittings as shown in Table 2.

PROCEDURE	WELDER APPROVAL	WELDED FITTINGS AND PIPE
BS EN 12732 BS 2971(arc welding)	BS EN 12732 BS EN 287-1 BS EN ISO 15614-1 BS EN 288-9 BS 4872-1	BS 1640-3 BS 1560-3.2 BS EN 10253-1 BS 3799 BS EN 1092-1 GIS/L2

TABLE 2 - WELDING STANDARDS

- 3.5.2.2 Welding procedures shall be produced and they shall be approved by independent personnel certified to an appropriate level.

Note: Such schemes in operation in the UK at the time of publication of IGEN/G/5 Edition 2 are the BGAS Inspector Approval Scheme and the Certification Scheme for Welding Inspection Personnel, both of which are administered by The Welding Institute (TWI).

- 3.5.2.3 All welding procedures and welder approvals shall conform to the base standard, e.g. appropriate part of BS EN 288 or its successor standards (BS EN 15609, 15610, 15611, 15612, 15613 or 15614). All documentation relating to procedure approval welds, including the test results, shall be approved by the Adopting Gas Transporter/Asset Owner prior to the commencement of production welding and the approval of welders.

- 3.5.2.4 Welding shall only be carried out by someone who has demonstrated their ability to produce welds meeting the requirements of the welding specification.

Note: This may either be by producing a satisfactory test weld against the approved procedure(s) on site in the presence of a qualified welding inspector or having been assessed in accordance with BS EN 287-1 at an approved Assessment Centre or on site by a qualified Welding Inspector within the previous 12 months. In the latter case, documentary evidence will be needed.

- 3.5.2.5 Unless otherwise specified by the adopting GT, the minimum level of inspection shall be as specified in BS EN 12732 from which Table 3 has been constructed.

TYPE/POSITION OF THE WELD JOINT	VISUAL EXAMINATION BY WELDING INSPECTOR	RADIOGRAPHIC AND ULTRASONIC EXAMINATION	SURFACE CRACK TEST
Unconcealed circumferential welds, branches, nozzles and fillet welds: longitudinal seams	10%	Minimum of 1 joint (see notes 1 and 2)	10%
Concealed pipe spans	100%	Minimum of 1 joint (see note 3)	100%

TABLE 3 – WELDING INSPECTION

Note 1: Provided the same welder works on a regular basis throughout a 12 month period on various sites, a single acceptable radiograph inspection (from the initial site) or suitable test radiograph would normally be acceptable to the GT provided there are no failures in production welding.

Note 2: The Adopting GT/Asset Owner may nominate a fillet joint to be sectioned for further examination.

Note 3: The Adopting GT/Asset Owner may require for additional radiography to be undertaken taking account of external loads, supports, ambient temperature differentials, etc.

Note 4: If the percentage of radiography reveals a defective weld, two welds on either side of this defective weld will need to be radiographed.

Note 5: If any of these additional welds contain an unacceptable defect, the level of radiography will need to be increased to 100% of completed welds. This level of radiography may only return to the standard level when the cause of the defect has been established and corrective action taken, or, if all the welds additionally inspected are acceptable, radiography can return to the standard level.

SECTION 4 : PLANNING

4.1 GENERAL

4.1.1 Consideration shall be given to the special circumstances that may result from supplying gas to differing types and configurations of multi-occupancy buildings.

4.1.2 Owners and operators of network pipelines, primary meter installations, installation pipework, appliances and chimneys have legal obligations with respect to safe operation and to maintenance. At the design stage, appropriate plans of the equipment, gas supply and building (as required by the future owner/operator of the particular asset) shall be made available to that owner/operator.

Note 1: As well as legal obligations, the future owner/operator may have a policy relating to the design of a particular section of the gas supply system. Nothing in this Standard imposes an obligation on the future owner/operator to "adopt" any section of the gas supply system.

Note 2: As examples:

- *a GT has legal obligations with respect to safe operation and maintenance of network pipelines under PSR (see clause 3.2.6)*
- *a MAM has obligations with respect to safe operation and maintenance of meter installations under the Ofgem MAMCoP*
- *a local authority, frequently as the landlord for a block of flats, has obligations with respect to periodic inspections of installation pipework and appliances under GS(I&U)R.*

4.1.3 Any network pipeline, PRI, meter installation, installation pipework, appliance, chimney or ventilation shall be designed and installed in accordance with an appropriate standard, as shown in Table 4. In addition, all pipes, pipework, meter installations, appliances, chimneys and ventilation shall be installed in accordance with any further relevant clauses contained in this Standard.

COMPONENT	STANDARD
Network pipeline	IGE/TD/3 IGE/TD/4 IGE/GL/1
PRI	IGEM/TD/13
Meter installation (see Note below)	BS 6400-1; BS 6400-2 IGEM/GM/6; IGE/GM/8
Installation pipework	BS 6891; IGE/UP/2
Appliances	See Table 10
Chimneys and ventilation	BS 5400-1; BS 5400-2; IGE/UP/17; BS 8313

Note: This Standard assumes a "Standard gas supply arrangement" as described in IGE/G/1.

TABLE 4 - NETWORK, METER INSTALLATION, INSTALLATION PIPEWORK, APPLIANCE AND CHIMNEY DESIGN AND INSTALLATION STANDARDS

4.1.4 Where existing pipes, fittings or appliances are no longer to be used:

- for a network pipeline the redundant pipe and fittings should be removed and shall be permanently de-commissioned in accordance with IGE/TD/3 or IGE/TD/4, as appropriate
- for a meter installation, installation pipework, appliance or chimney, the redundant pipework should be removed and shall be permanently and de-commissioned in accordance with IGE/UP/1, IGE/UP/1A, IGE/UP/1B, IGE/UP/1C or IGE/UP/17, as appropriate.

Note: Legal notification requirements are in the Gas Meters (Information on Connection and Disconnection) Regulations.

If redundant pipework is left in place, it should be clearly identified as serving no function.

- 4.1.5 The designer/building owner should be made aware of the presence of any external steel riser to allow assessment of the possible consequences for the lightning protection of the building.

4.2 **RISK ASSESSMENT**

The legal requirements referred to in Sub-Section 4.1 are based on reducing risks 'So Far As Is Reasonably Practicable', more commonly referred to as 'As Low As Reasonably Practicable' (ALARP). Where there are established or standard designs, this requirement can be met by the application of standards and best practice. Where there are not, as with all multi-occupancy buildings, a risk assessment approach is required in addition to demonstrate the necessary risk reduction.

Note: IGE/SR/24 provides more information on techniques used in risk assessment.

4.2.1 **Minimising the risk**

- 4.2.1.1 A risk assessment shall be undertaken and the results recorded. The risk assessment should take account of the advice given in this Standard.

Different installation design options result in different hazards and potentially different levels of risk. A systematic approach is required to minimise the risk.

The risk assessment shall include the following elements:

- hazard identification
- hazard reduction, including the application of inherent safety principles
- evaluation of failure modes
- evaluation of release frequency
- evaluation of release consequences
- risk mitigation, consideration of risk reduction options
- an assessment of the significance of the risk.

Note 1: It may not be possible to quantify the risk of all elements, particularly for failure frequency (rate). Failure modes can generally be identified based on experience and engineering judgement, and the consequences of a release of Natural Gas are able to be assessed.

Note 2: While it is possible for the majority of detached, semi-detached and terraced houses to specify standard designs to readily meet this clause, for multi-occupancy buildings the variety of building types, configurations, methods of construction and patterns of residency make such specification more difficult.

The process is iterative at each stage, i.e. if the likelihood of failure appears unacceptable, the process is not continued, an alternative design is considered; likewise with the consequences. The process is concluded when the design can be demonstrated to be ALARP, when any further risk reduction is 'not reasonably practicable'. See Appendix 3 for further information on the risk assessment process.

- 4.2.1.2 A generic consideration of the hazards and risks from different supply options leads to a number of general principles:
- gas supplies should, as far as possible, be sited out of doors or in well ventilated spaces
 - gas supplies should be excluded from poorly ventilated or strongly confined spaces such as basements and cellars
 - apparatus should be sited to avoid accidental damage or interference with the supply wherever possible
 - consideration shall be given to the location of the supply with respect to the ability of the structure to withstand the consequences of an ignition in the event of a gas escape.

Note: These principles form the basis of identifying the preferred hierarchy of supply options.

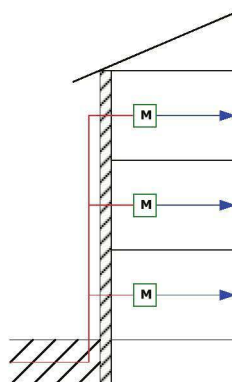
- 4.2.1.3 The designer shall consider the most appropriate design option based on consideration of safety, security, future access and maintenance and the specific requirements of the adopting GT.

- 4.2.1.4 Consideration shall be given to the following examples of typical options available for the supply of gas to multi-occupancy buildings. They are presented as a general hierarchy relating to overall safety.

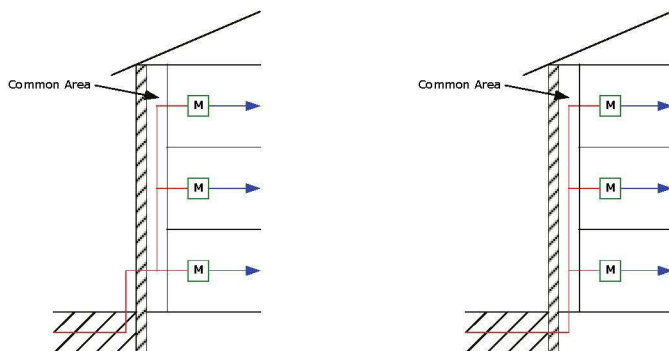
Note: Option (a) is at the top of the hierarchy with Option (d) at the bottom.

In general, the lower the option in the hierarchy the greater attention to risk mitigation is required. However, this cannot be applied as a general rule as there are several factors which may have a bearing on overall safety, such as method of ventilation, the position of meters, the number of meters in a meter bank, access to components, the number of joints, the length of pipe and pipework in buildings, means of escape, future access for inspection and maintenance, type of chimney (individual or shared) etc. Therefore, an overall risk assessment shall be carried out before deciding upon the final design. The hierarchy of designs given in this Standard are:

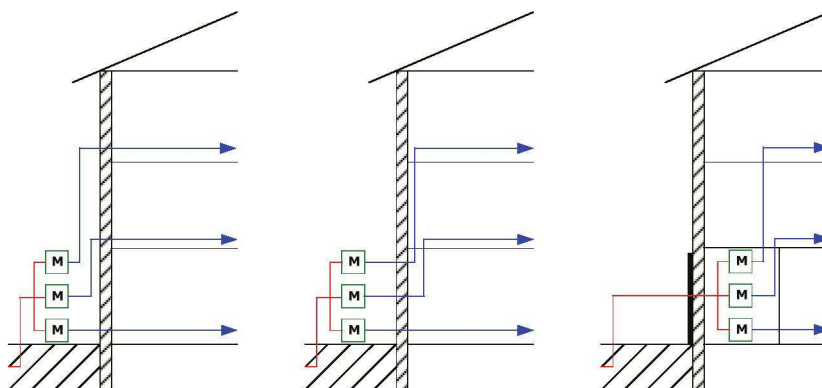
- (a) External network with laterals supplying primary meter installations located immediately on the inside of an external wall.



- (b(i)) Network pipeline with an above ground, or buried short length below-ground, entry serving internal network riser(s) accessible from a common area with lateral(s) supplying primary meter installations and connected to installation pipework for each individual dwelling.



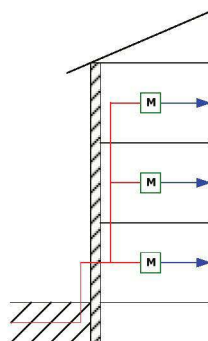
- (b(ii)) Network pipeline supplying external (see clause 4.2.1.8 for internal designs) primary meter installations connected to individual external or internal installation pipework risers and laterals for each individual dwelling.



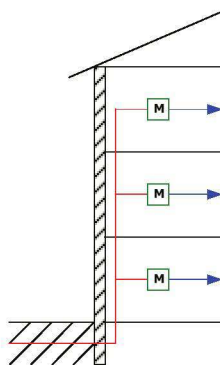
Note: In some cases, a network pipeline may supply an external bulk primary meter installation.

Options b(i) and b(ii) are nominally equal in the hierarchy – the actual preference would be based upon individual circumstances and the level of the risks such as susceptibility to vandalism, number and position of meters in groups etc.

- (c) Network pipeline with an above ground entry, serving internal network riser(s) accessible from within the flat with lateral(s) supplying primary meter installations and connected to installation pipework for each individual dwelling.



- (d) Network pipeline with Standard below-ground entry serving network riser(s) with laterals supplying primary meter installations connected to installation pipework for each individual dwelling.



A network pipeline or sleeve entering a building below ground should be brought above ground as soon as is reasonably practicable and shall be one continuous length or welded; mechanical joints shall not be used below ground. If this is achieved within 2 m of the building external wall, then the design generally may be placed in option (d). However, where this is not reasonably practicable, and the length of pipeline under the building exceeds 2 m, there are several issues to bear in mind:

- this Standard does not fully address such designs and the risk assessment should consider this aspect in detail, particularly with regard to access for maintenance and inspection as required by PSR
- the GT may require evidence that it is not reasonably practicable to have a shorter distance of pipeline under the building
- the GT may consider the design to be unsuitable for adoption i.e. not fit for purpose
- if as a result of deep penetration into a building, the resultant above ground network pipeline requires separate ducted ventilation, specialist advice will be needed.

4.2.1.5

The general hierarchy (clause 4.2.1.4) of options available implies a scale available for design, all of which imply a scale of risk requiring increased mitigation measures. The objective is to achieve the same overall risk levels for all design options, as if for the lowest risk option. Notwithstanding the hierarchy, this Standard permits all the mentioned options with the appropriate risk mitigation measures in place. The lower the design is in the hierarchy, the greater the importance of early communication with the future owner/operator to establish acceptance in principle, and/or any need for further mitigation measures. Typical areas that give rise to concern, with the party responsible shown in parentheses (see Table 1), include but are not limited to the following:

- (i) long lengths of network pipelines where access is impracticable, under a building (GTs)
- (ii) ventilation of network pipelines and installation pipework that are not obviously under the control of the owner/operator. For example, long lengths of ducted ventilation air compared to simple ventilation direct to outside (GTs and owners of installation pipework)
- (iii) gas installations within timber frame buildings (GTs and owners of installation pipework, appliances and chimneys)
- (iv) the location of meter installations in relation to common means of escape (MAMs/meter owners, GTs and owners of installation pipework)
- (v) ready access to ECVs (GTs, and owners of installation pipework)
- (vi) more than one network pipeline entry into a common area of a building (GTs).

While not disallowing designs under (i) and (ii), this Standard does not fully address all the potential issues and in such cases specialist advice shall be sought.

- 4.2.1.6 Buildings whose design renders them susceptible to progressive collapse shall not be supplied with gas unless a written assurance is obtained from the owners that the building has been satisfactorily strengthened.

Note: Modern practices require disproportionate collapse to be taken into account for buildings (see for example, the Building Regulations (England and Wales) ADA).

- 4.2.1.7 Timber-framed buildings are subject to significant shrinkage movement and require special attention.

The hierarchy of clause 4.2.1.4 shall be considered for timber frame buildings. Each supply option has to address the expected differential movement between the timber frame (see Appendix 6) and the 'fixed' sections, i.e. the masonry outer walls, the inner common areas and the internal gas supply. Whichever option is chosen, provision shall be made to manage the differential movement and to accommodate any resultant stresses should the provision not be effective or cease to function.

- 4.2.1.8 Developments, whether new or refurbishment, require a high level of co-operation between the gas designer, the developer and other utility providers above and beyond that required by CDM, especially where meters, and hence network pipelines, are proposed to be located within a building.

Any meter located inside a building shall be positioned with due regard to the following, which shall not be considered an exhaustive list:

- the nature and use of the building
- the type of occupants, including those with special needs
- the location and type of construction of all the gas pipework within the building
- the protection of the means of escape in the case of fire, explosion or other emergency
- the safe ventilation of potential gas leaks
- Building Regulations and Building Standards
- access to valves, pipes, meters, sleeves and ventilation systems, for inspection, maintenance and repair in the future
- connection to network risers and laterals
- proximity to other services, appliances, chimneys etc.

The meter installation shall be installed in accordance with BS 6400, IGE/GM/6 or IGE/GM/8, as appropriate.

Note: The position of meters has an influence on the design hierarchy and hence on the risk reduction measures required. For example, groups of meters in meter rooms within a building may present a higher risk than individual meters installed at each individual dwelling which may, in turn, present a higher risk than meters installed outside a building, and so on.

4.3 ASSESSMENT OF GAS LOAD

4.3.1 General

- 4.3.1.1 The gas load shall be assessed to determine the gas flow requirements of the network pipeline.

Note: Assessment of gas load is covered in IGE/GL/1, BS 6400 and adopting GT publications.

4.3.1.2 Any system, including a meter bank manifold, should be designed to meet the maximum diversified demand likely to be placed upon it (see Sub-Section 4.3.2).

4.3.1.3 The designer shall establish the system design minimum pressure (DmP).

Note: GTs will provide source pressure information to assist designers to size any network pipeline, meter bank, riser and lateral so that the pressure at any ECV is greater than or equal to DmP. On request, the relevant GT will provide the full range of operating pressures. IGE/TD/101 gives information on obtaining pressure information.

4.3.2 **Diversity**

4.3.2.1 For supplies to a group of dwellings, reference should be made to the information on the design flow rate given in Appendix 5 of IGE/GL/1, in the form of diversity curves, which relate the probable peak flow for groups of consumers.

4.3.2.2 Care should be taken when estimating the design load when 10 or fewer consumers are being supplied from a network pipeline or meter bank and/or where there is a possibility of large (e.g. 40 kW input) combination boilers being installed. Consideration shall be given to undertaking a sensitivity analysis using diversified and non-diversified loads.

4.3.2.3 For supplies to an individual dwelling, the design flow rate should be based on the estimated maximum demand which should be assessed from BS 6400, as appropriate.

4.3.3 **Flow Equation**

4.3.3.1 For the design of systems, the Smooth Pipe Law should be used (see IGE/TD/3). This is the most appropriate for the partially turbulent flow conditions likely to be prevalent.

Note: There are numerous flow equations in existence although most are variations on, or approximations to, the Smooth Pipe Law.

4.3.4 **Pressure loss due to pipe components**

4.3.4.1 For valves, elbows, etc. an additional length should be added to the estimated pipe length to compensate for the effects on pressure drop and for accuracy. Reference should be made to manufacturer's data. In the absence of manufacturer's data, advice may be sought from standards such as IGE/UP/2.

4.3.4.2 Where a risk assessment indicates an excess flow valve (EFV) and/or a thermal cut-off device (TCO) is required, the pressure drop across the EFV/TCO shall be taken into account, and shall meet the overall requirements of:

- the GT, if fitted upstream of an ECV
- BS 6400, IGE/GM/6 or IGE/GM/8 as appropriate, if fitted within the meter installation
- BS 6891 or IGE/UP/2 as appropriate, if fitted within the installation pipework.

4.3.5 **Effect of Altitude**

4.3.5.1 Consideration shall be given to compensating for the effect of altitude on riser systems. Lighter than air gases will show an increase in pressure due to altitude. The following formula may be used:

$$h = 0.123(1-s)H$$

h = pressure change due to altitude (mbar)

H = altitude change (m)

s = density of gas relative to air (dimensionless)

Note 1: The density of NG relative to air is 0.6.

Note 2: The pressure gain may be of use in the design of riser system, but checks will need to be made to ensure unacceptable pressures are not experienced at the appliance.

4.4 **ACCESS AND SECURITY**

4.4.1 Consideration shall be given to the structure and design of the building with respect to access to:

- the gas supply system for maintenance
- action in emergencies
- the safety and security of gas pipes and associated equipment.

4.4.2 Provision must be made for safe and adequate access for the inspection of any riser, valve, lateral, meter, and other gas equipment.

Access panels for network pipes and valves must comply with the Building Regulations and should be easily removable by one person e.g. requiring standard tools. The removal and replacement of the panel should not impair the effectiveness of any seal.

Fire integrity and air tightness shall not be compromised by the design of the access panel.

SECTION 5 : METER INSTALLATIONS

5.1 GENERAL

Gas meter installations that supply gas to individual dwellings should be arranged as follows:

- individual primary meters within, adjacent to or remote from the individual dwellings they serve (see Figures 1 to 5 and Sub-Section 5.3) or
- multiple primary meter installations (meter banks) situated remote from the dwellings they serve (see Figure 5 and Sub-Section 5.4) or
- a bulk primary meter situated remote from, or adjacent to, the multiple individual dwellings it serves (see Figure 6, a secondary meter may not always be fitted).

Note 1: Whether within an individual dwelling, within the building or in a separate meter housing outside the building, the accommodation and construction of the meter housing has to be approved by the GT (Gas Act, Section 5, Schedule 2b).

Note 2: Where gas is supplied to a single primary meter serving communal heating plant or an energy centre, see Section 8.

Note 3: Information on AECVs is given in Section 7.

5.2 SITING METHODS

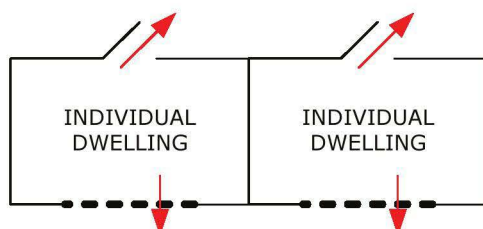
5.2.1 Definitions of means of escape

Building Regulations, GS(I&U)R and Standards adopt terms to describe types of means of escape. The terms adopted by this Standard may differ from official descriptions to aid clarity. The following terms are used in IGEM/G/5 and shall be referenced when designing a meter installation and/or determining the termination point(s) of the network.

Note: A lift is not considered to be a means of escape, under any circumstances.

(a) Means of escape

A route used for escape by occupants of one or more individual dwelling(s) from one area of a building to another and to outside. Figure 7 provides a simple example.

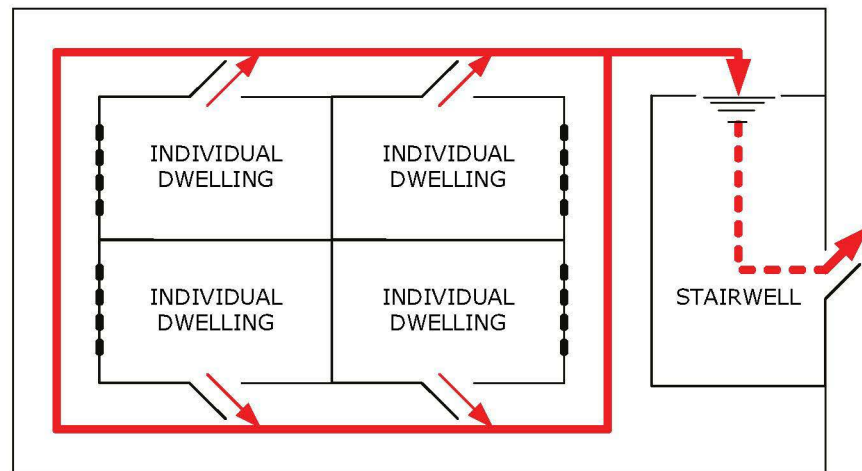


Door (all situations) and openable and suitably sized window (ground and 1st floor only)

FIGURE 7 - EXAMPLE OF A "MEANS OF ESCAPE"

(b) Common means of escape

A route used for escape by occupants of more than one individual dwelling from one area of a building to another and to outside, and includes any area adjoining that route other than an individual dwelling. Figure 8 provides an example.



Note: This depicts a common means of escape (see clause 5.2.1 (b)) that is also a common sole means of escape (see clause 5.2.1 (d)).

FIGURE 8 - EXAMPLE OF A "COMMON MEANS OF ESCAPE"

(c) Common alternative means of escape

A route used for escape by occupants of more than one individual dwelling from one area of a building to another and to outside, where an alternative escape route exists. Figure 9 provides an example.

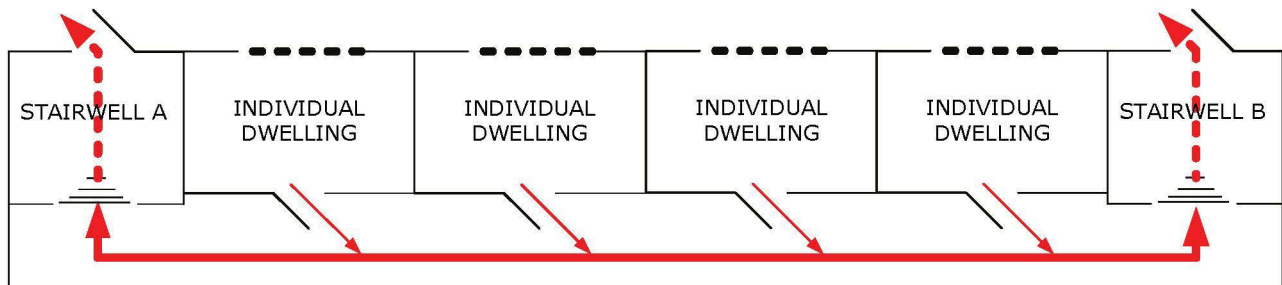


FIGURE 9 - EXAMPLE OF A "COMMON ALTERNATIVE MEANS OF ESCAPE"

(d) **Common sole means of escape**

A route used for escape by occupants of more than one individual dwelling from one area of a building to another and to outside, where no other route exists or where any other route is not a common alternative means of escape (see (c) above). Figure 10 provides an example.

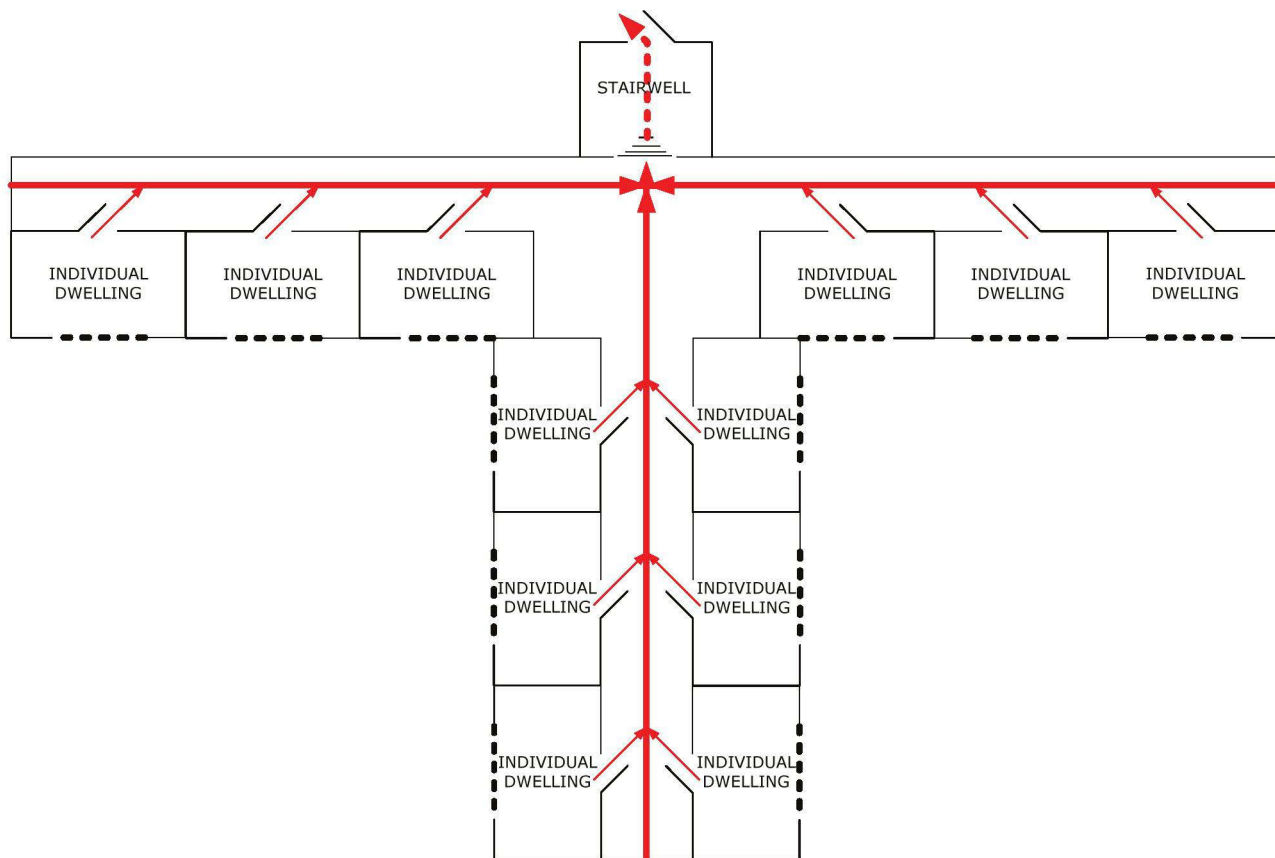


FIGURE 10 - EXAMPLE OF A "COMMON SOLE MEANS OF ESCAPE"

5.2.2 Siting meters with respect to common escape routes

5.2.2.1 Due account must be taken of relevant requirements in the Building Regulations. It may be necessary to install meters in meter rooms or compounds/enclosures.

5.2.2.2 Meters should not be sited on or under the stairway, or in any other part of the premises, where the stairway or that other part of the premises forms the **common means of escape** in case of fire.

Note 1: New installations with two or more floors above the ground floor have to be installed in accordance with clause 5.2.2.2 (see Guidance Note 106 in HSL56 to Regulations 12(1) and 12(2) of GS(I&U)R).

5.2.2.3 Replacement meters should be installed, so far as is reasonably practicable, in accordance with clause 5.2.2.2. If it is necessary to install a replacement meter on or under a stairway, or in any other part of premises, where the stairway or that other part of the premises forms the **common means of escape** in the case of fire:

- (a) the meter should be fire-resistant, or
- (b) the meter should be housed in a fire-resistant compartment with automatic self-closing doors, or
- (c) the pipe immediately upstream of the meter, or regulator if fitted, should be provided with a thermal cut-off device which is designed to automatically cut off the gas supply if the temperature of the device exceeds approximately 100°C.

- 5.2.2.4 A meter must not be installed in any **common sole means of escape** nor in any room, box, cupboard, or other compartment or compound/enclosure that opens onto a **common sole means of escape**.

Note: In the context of this clause, a room is not intended to mean a room contained in an individual dwelling.

A meter shall not be installed in a meter room where fire doors are used to create a false or intermediate lobby between the meter room and the **common sole means of escape**.

- 5.2.2.5 A meter shall not be installed in any **common alternative means of escape** unless:

- a risk assessment (see Sub-Section 4.2) indicates the risk of an incident removing all means of escape is acceptable **and**
- the **common alternative means of escape** is independent of the other **alternative means of escape** such that a fire or explosion in one means of escape will not affect escape by occupants of the building by the other means of escape (such independent means of escape are rare with modern designs of buildings) **or**
- the particular means of escape on which a meter is to be installed is largely exposed to outside air when escaping gas would quickly disperse, **or**
- an EFV is installed. In addition, the meter shall be enclosed in a room, box, cupboard or other compartment (which may open onto the **common alternative means of escape**) that is at least 30 minute fire resistant to BS 476 and have a self-closing door. In addition, the pipe immediately upstream of the meter installation, shall be provided with a TCO.

Note: Where fitted, the EFV and TCO need to comply with an appropriate Standard (see Section 7.9 and Table 11) and consideration needs to be given to the pressure drop (see clause 4.3.4.2).

5.2.3 **Siting meters with respect to sole escape routes within individual dwellings**

- 5.2.3.1 If it is proposed to install a meter in a **sole means of escape** within an individual dwelling, either:

- the meter shall be enclosed in a box, cupboard or other compartment (which may open onto the sole means of escape from within the individual dwelling) which is at least 30 minute fire resistant to BS 476 and which has a self-closing door, **or**
- the pipe immediately upstream of the meter installation, shall be provided with a TCO.

Note 1: For an individual dwelling situated at ground or 1st floor level, having an exit point other than the normal exit, the normal exit is not considered to be a sole means of escape.

Note 2: Any meter installed inside the property also needs to be fire-resistant (see BS 6400). Meters marked with a "T" in accordance with BS EN 1359 or refurbished meters that have no "SJ" mark conforming to BS 4161-3 or BS 4161-5 can be considered fire resistant.

Note 3: Where fitted, the TCO needs to comply with an appropriate Standard (see Section 7.9 and Table 11) and consideration needs to be given to the pressure drop (see clause 4.3.4.2).

5.2.4 **Siting meters with respect to building structure and environment**

A meter shall not be installed:

- where the consequences of a gas escape, fire or explosion at the meter would compromise the integrity of the structure of the building
- in any area subject to excesses of moisture, corrosive materials, heat, etc.

If necessary, the advice of a structural engineer shall be sought to determine a satisfactory location.

5.2.5 **Siting individual meters with respect to electrical apparatus**

Where a gas meter and its associated fittings cannot be fitted more than 150 mm from an electricity meter/electrical apparatus or more than 25 mm away from the electricity supply and distribution cables, a non-combustible partition made of an electrically insulating material shall be placed between them.

5.2.6 **Meter box installation - timber framed buildings**

A meter box shall not be inset into a structural timber panel.

Note: Where a cladding of thickness less than 100 mm of masonry is used, the use of an inset meter box is not acceptable.

5.3 **INDIVIDUAL METER INSTALLATIONS**

5.3.1 **Domestic-sized meter installations (maximum capacity $\leq 6 \text{ m}^3 \text{ h}^{-1}$)**

5.3.1.1 Any meter installation shall be installed in an area with adequate ventilation, such as:

- a purpose-made outside meter box or housing with purpose-provided ventilation
- for a single low pressure ($\leq 75 \text{ mbar}$) meter installation only, an open area, or cupboard with adequate ventilation, within an individual dwelling.

Note 1: A normally-occupied individual dwelling is deemed to be adequately ventilated for the purposes of installing a domestic-sized low pressure meter supplying only that dwelling. Otherwise, adequate ventilation may be calculated in accordance with clause 5.3.2.1 and positioned so as not to compromise fire safety if located in a fire resistant hallway.

Note 2: Further information can be found in BS 6400-1 and BS 6400-2 as appropriate.

Note 3: BS 8499 specifies requirements for purpose made outside meter boxes for use with single meter installations conforming to BS 6400-1 and BS 6400-2.

5.3.1.2 Any compound/enclosure for a meter installation shall be ventilated (see clause 5.3.1.1) such that it can be designated hazardous area Zone 2.

5.3.2 **Other meter installations (maximum capacity $> 6 \text{ m}^3 \text{ h}^{-1}$)**

5.3.2.1 The total effective ventilation area (free area) shall be not less than the lower of 2% of the internal floor area or its notional equivalent area.

Where ventilation is provided in one wall only, the minimum total effective ventilation area shall be increased from 2% to 3%.

Note: Further information can be found in IGEM/GM/6 and IGE/GM/8 as appropriate.

5.3.2.2 A hazardous area assessment shall be undertaken (see IGEM/GM/7B).

5.3.2.3 Where electrical equipment and/or other potential sources of ignition is/are to be installed in the enclosure, reference shall be made to IGEM/GM/7A, IGE/GM/8 and BS 7671.

5.4 MULTIPLE METER INSTALLATIONS (METER BANKS)

5.4.1 Meter banks shall be in a dedicated compound/enclosure.

Note 1: A meter bank has two or more primary meter installations in a single ventilated compound/enclosure. The meter installations are supplied from a manifold at the end of a single network pipeline.

Note 2: Individual meter installations located in outside meter boxes and which are supplied by individual services does not constitute a meter bank.

5.4.2 Meters shall have a low pressure (≤ 75 mbar) supply.

5.4.3 Meter bank compound/enclosures shall have adequate natural ventilation direct to the outside.

Note: Mechanical ventilation for other purposes is permitted in areas containing meters (but see clause 5.4.4) provided the calculated amount of natural ventilation is also present.

5.4.4 Any compound/enclosure for a meter bank shall be ventilated such that it can be designated hazardous area Zone 2.

The total effective ventilation area (free area) shall be not less than the lower of 2% of the internal floor area of the enclosure or its notional equivalent floor area taken from Table 5.

Where ventilation is provided in one wall only, the minimum total effective ventilation area shall be increased from 2% to 3%.

NUMBER OF DOMESTIC METERS	NOTIONAL FLOOR AREA, AT 0.5 m ² PER METER	TOTAL VENTILATION AREA AT 2% OF NOTIONAL FLOOR AREA
2	1 m ²	0.02 m ²
10	5 m ²	0.1 m ²

Note: Actual ventilator dimensions will be larger than the calculated free area dimensions, as ventilators are partially restricted by the grille structure.

TABLE 5 - EXAMPLE NOTIONAL FLOOR AREAS AND VENTILATION AREAS

5.4.5 The calculated ventilation area shall be equally apportioned between high level and low level ventilators.

Note: Ideally, this would be apportioned to all four walls and/or doors.

5.4.6 If ventilation is provided via one or more ducts, the duct(s) shall be fire resistant unless this is not required for fire protection purposes.

5.4.7 Where electrical equipment and/or other potential sources of ignition is/are to be installed in the compound/enclosure, it shall be suitable for a Zone 2 hazardous area.

5.4.8 The compound/enclosure shall comprise a room, cupboard or a secure area, designed and fit for the purpose.

5.4.9 The compound/enclosure shall be designed and sealed so that any escaping gas will not pass to any part of any building.

Note: Compliance with Sub-Section 5.2 has to be achieved.

- 5.4.10 The compound/enclosure door shall be self closing and self latching and should be locked.
- For a compound/enclosure large enough for persons to enter, it shall be possible to exit the compound/enclosure without the use of keys, etc.
- 5.4.11 The consumer and authorised persons shall have unrestricted access (for example, keys being readily available) to the compound/enclosure.
- 5.4.12 Smoking and the use of naked flames shall be prohibited in the immediate vicinity of the compound/enclosure.
- 5.4.13 Each meter and its associated installation pipework shall be clearly and permanently identified to indicate which particular dwelling it serves.
- Note: This may be best achieved during construction.*
- 5.4.14 A sign shall be placed in a prominent position outside the compound/enclosure to advise the GT/ESP/Gas Conveyor/MAM/consumer/meter reader where the keys to the compound/enclosure may be found.
- 5.4.15 A label for the meter bank shall be placed in a prominent position, and should be within sight of the meters and ECVs. The label should provide the following information:
- actions to take in the event of a suspected gas escape
 - line diagram
 - gas pressures
 - equipotential bonding
 - security seals
 - an EX label (indicates the presence of a hazardous area as defined in IGEN/G/4)
 - "no smoking" and "gas escapes" labels.

Figure 11 provides a typical example of this comprehensive composite notice.

[illegible]

FIGURE 11 - COMPOSITE LABEL

SECTION 6 : NETWORK PIPELINES

This Section applies when considering entry and routing of a network pipeline into a multi-occupancy building up to the ECV. It equally applies, where relevant, when considering entry into a meter bank compound/enclosure attached to, or remote from, a multi-occupancy building.

6.1 GENERAL

6.1.1 Any network pipeline shall be installed only in a position in which it can be used with safety, having regard to the position of other nearby services, for example electricity, water, etc. and to such parts of the structure of the building through which it is laid.

6.1.2 The preferred hierarchy for the approach, entry (if chosen) and termination of a pipeline should be as given in Section 4.

Note: The Gas Act, PSR and IGE/TD/4 require the line of the service, from the distribution main, to take the shortest practicable route, notwithstanding diversion for such as manholes. This principle equally applies for a main that enters a building.

6.1.3 Any network pipeline shall be installed so as not to impair the structure or the fire resistance of any part of the structure of the building, for example compartment walls, methane barriers or the damp proof course (DPC).

6.1.4 Where required to be fire resistant, materials and/or protection shall be in accordance with BS 476-20, 21, 22 and 23, as appropriate.

6.1.5 Any network pipeline installed above ground level shall be so placed or protected as to ensure that accidental damage to the pipeline is unlikely.

6.1.6 Any network pipeline installed above ground level shall be properly supported.

Note 1: Support may be provided by one or a combination of the following methods, as appropriate:

- for a vertical pipeline, at its base or from its top
- at various points along the pipeline (see Table 6).

Note 2: The following criteria need to be met:

- where the pipeline is attached to the building, the building structure needs to be capable of supporting the weight of the pipeline and building surfaces need to be suitable for attaching pipe supports
- the pipeline and its supports, joints and other components, such as valves, need to be strong enough to support the weight of the pipework and other stresses, such as those cause by unrestrained laterals
- pipeline supports need to permit pipeline expansion and building movement while limiting lateral movement of the pipeline.

Note 3: See also Sub-Section 6.4.

6.1.7 Polyethylene (PE) pipe shall not be used within a building except when installed in a fire and corrosion-resistant gas-tight steel system approved by the GT and for the purposes of a pipeline entry only.

6.1.8 Any PE pipe/fittings shall be shrouded or otherwise protected from sunlight.

6.1.9 Any underground steel section, including steel sleeves containing PE pipe, shall be constructed in accordance with IGE/TD/3 or IGE/TD/4, as appropriate, with particular respect to grade of pipe, wrapping or coating, cathodic protection (CP) and electrical insulation joints.

6.1.10 Network pipelines shall not be installed in the cavity of a cavity wall unless it is to pass through the wall or floor from one side to the other.

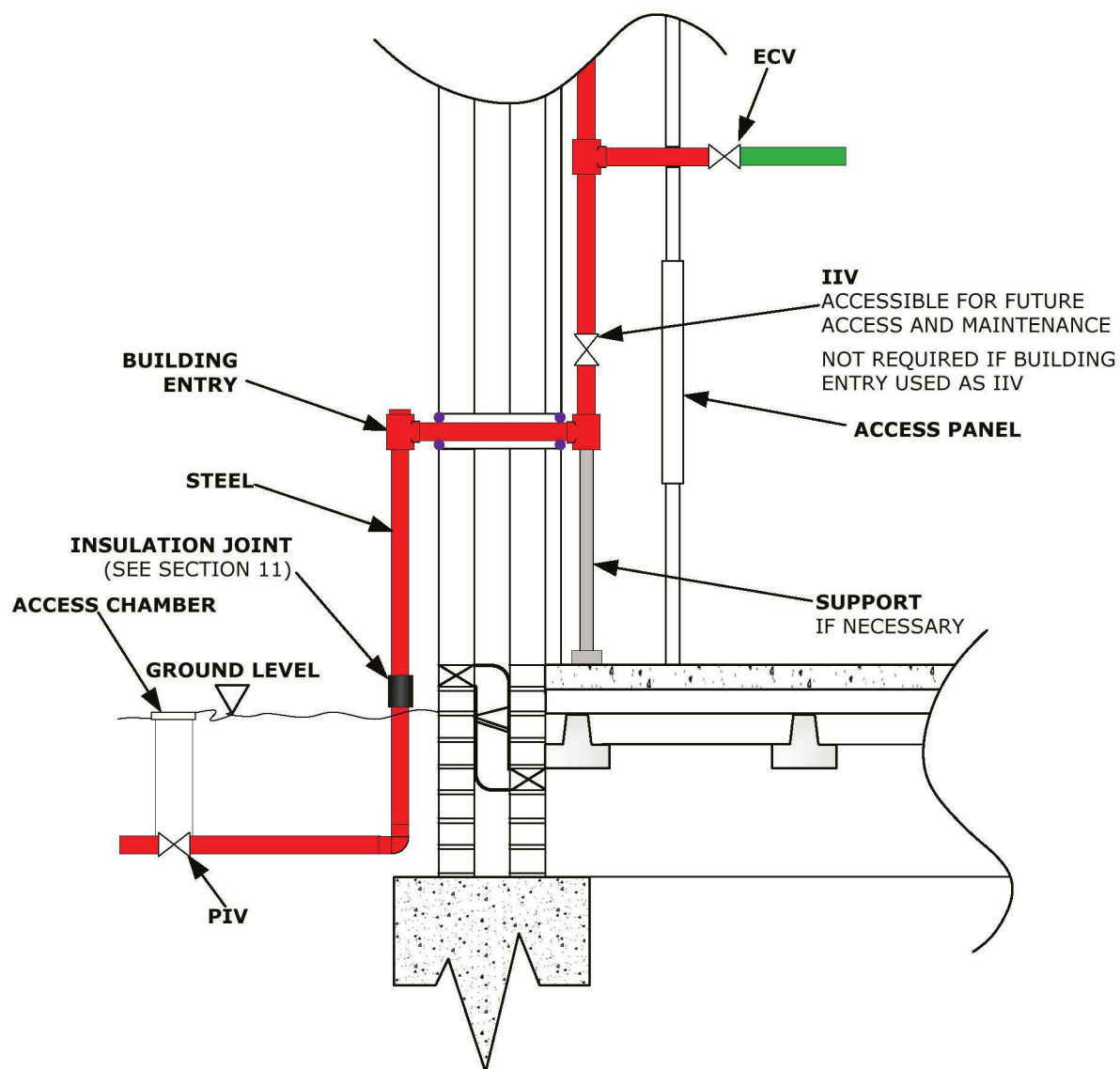
- 6.1.11 Where network pipelines are installed such that it passes through a cavity wall, solid wall or solid floor:
- it shall be by the shortest practicable route
 - it shall be enclosed in a sleeve and not contain mechanical joints
 - the annulus between pipe and sleeve shall be sealed with a fire resistant, flexible material, so as to prevent the passage of gas
 - the annulus between the sleeve and wall, and/or sleeve and floor, shall be sealed so as to prevent the passage of gas, with a fire resistant material
 - allowance shall be made for normal movement of the pipe and the building.
- 6.1.12 Network pipelines shall not be installed in an unventilated void space, unless continuously contained in a gas-tight metallic sleeve through the void.
- 6.1.13 Pipe shall not be installed in or under the foundations of a building, nor under the base of a load bearing wall, nor under a raft foundation.
- 6.1.14 For a timber-framed building, particular attention should be given in the design and installation to accommodate differential movement between the timber frame and any masonry or other structure, for example an external leaf or a stairwell, and the pipeline.
- 6.1.15 Any network pipeline shall be installed in a position so as to allow adequate access for installation, inspection, maintenance and repair. Wherever possible, working in a confined space shall be avoided.
- 6.1.16 Where there is more than one network pipeline entering a common area of a building a warning notice shall be placed at each entry stating that further network pipelines into the building exist.
- 6.1.17 Consideration shall be given to the provision of a line diagram at each building entry/IIV, depicting the dwellings served by that particular network pipeline.
- Where a line diagram is provided, it shall be updated to reflect any alterations carried out to the network pipeline and as part of a regular maintenance regime. Inspections shall be carried out to ensure that any line diagrams remain in place.
- 6.1.18 Consideration shall be given to labelling above ground network pipelines.

6.2 **ABOVE-GROUND ENTRY**

An above-ground entry provides easy access for maintenance and visual checks.

Note: Eliminating steel pipes below ground minimises the consequent risk of corrosion.

Principles of entry shall be as shown in Figures 12 and 13.



**FIGURE 12 - TYPICAL ABOVE-GROUND PIPELINE BUILDING ENTRY
(STEEL PIPE)**

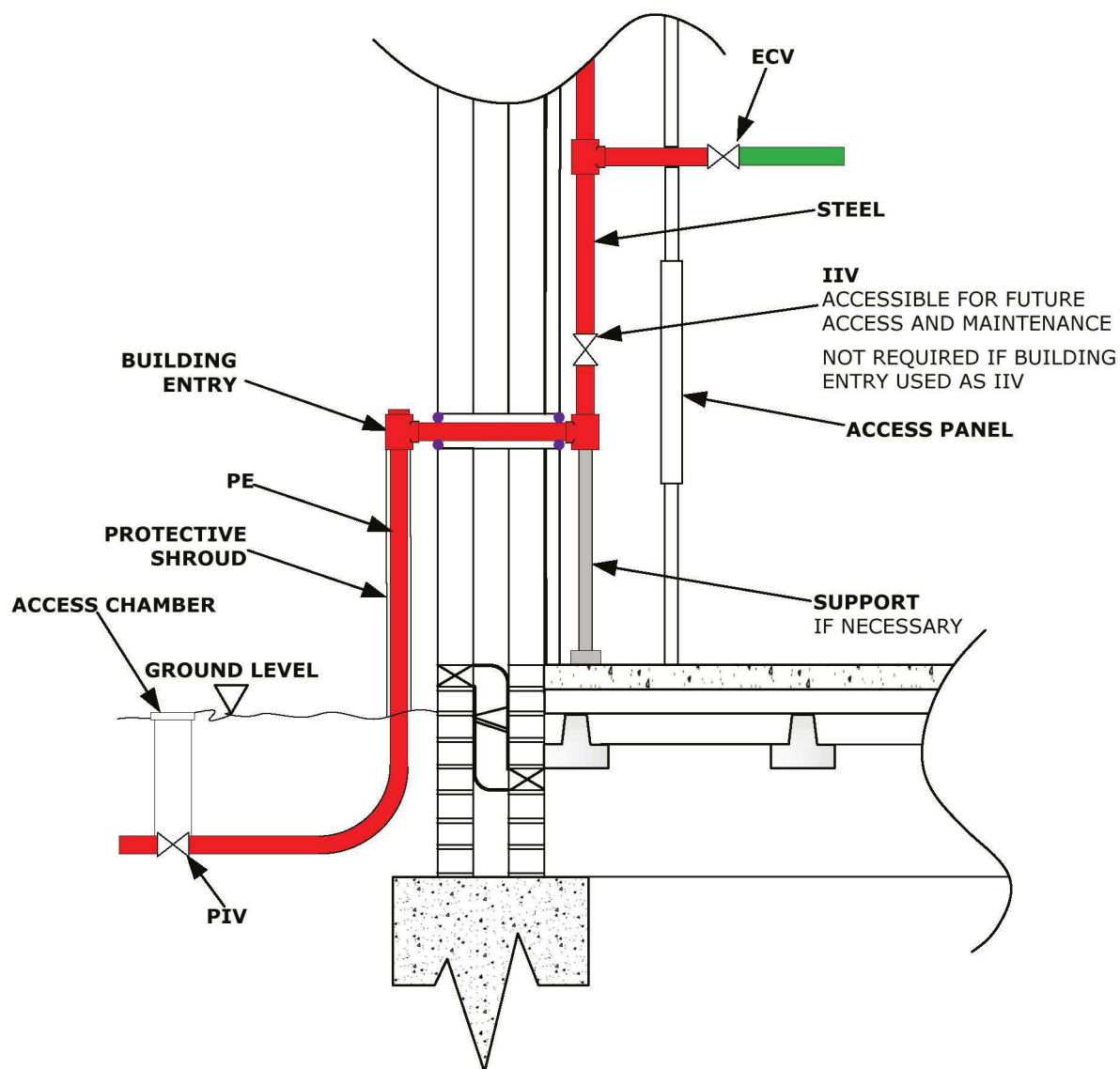


FIGURE 13 - TYPICAL ABOVE-GROUND PIPELINE BUILDING ENTRY (PE PIPE UP TO BUILDING ENTRY)

6.3 **BELOW-GROUND ENTRY**

6.3.1 **General**

Any below-ground entry shall be designed by a competent person who shall give consideration to:

- access to enable the installer to make proper joints both inside and outside of the building, and for the GT to undertake maintenance activities once the pipeline has been in use
- minimising the length of pipe under a building (see clause 4.2.1.4 (d))

Note: For network pipes, the GT may stipulate an allowable maximum length.

- risk of third party damage
- support for any riser
- ventilation of any duct or enclosed pipe
- corrosion, including wrapping and CP
- insulation joint to prevent stray current flow along metallic pipe or sleeve
- fire resistance
- access for future inspection and maintenance
- materials
- depth of pipe at the entry point
- any proposed future land and building use
- ensuring that, in the event of fire, safe egress from the building is not compromised.

6.3.1.1 Where multiple entries are unavoidable, consideration shall be given to mitigating the risk of such installations.

Note: This may include the use of positive labelling so that in the event of an emergency, all the appropriate valves are turned off (see clause 6.1.18).

6.3.2 **PE (see clause 4.2.1.4 (d))**

6.3.2.1 Pipe beneath any building shall be within a corrosion-protected steel carrier pipe which extends to the outside of the building. The annular space between the PE and the sleeve should be filled with an inert material.

Pipe should have a radius of curvature no tighter than 15 times its outside diameter. For ease of installation, consideration shall be given to the pre-fabrication and in-situ placement of larger-size entry fittings.

6.3.2.2 Pipe shall terminate with an appropriate fitting, for example a service head adaptor (see GIS/PL-3), which will not allow gas to escape to inside the building in the event of fire.

6.3.2.3 Entry should be in accordance with the principles shown in Figure 14.

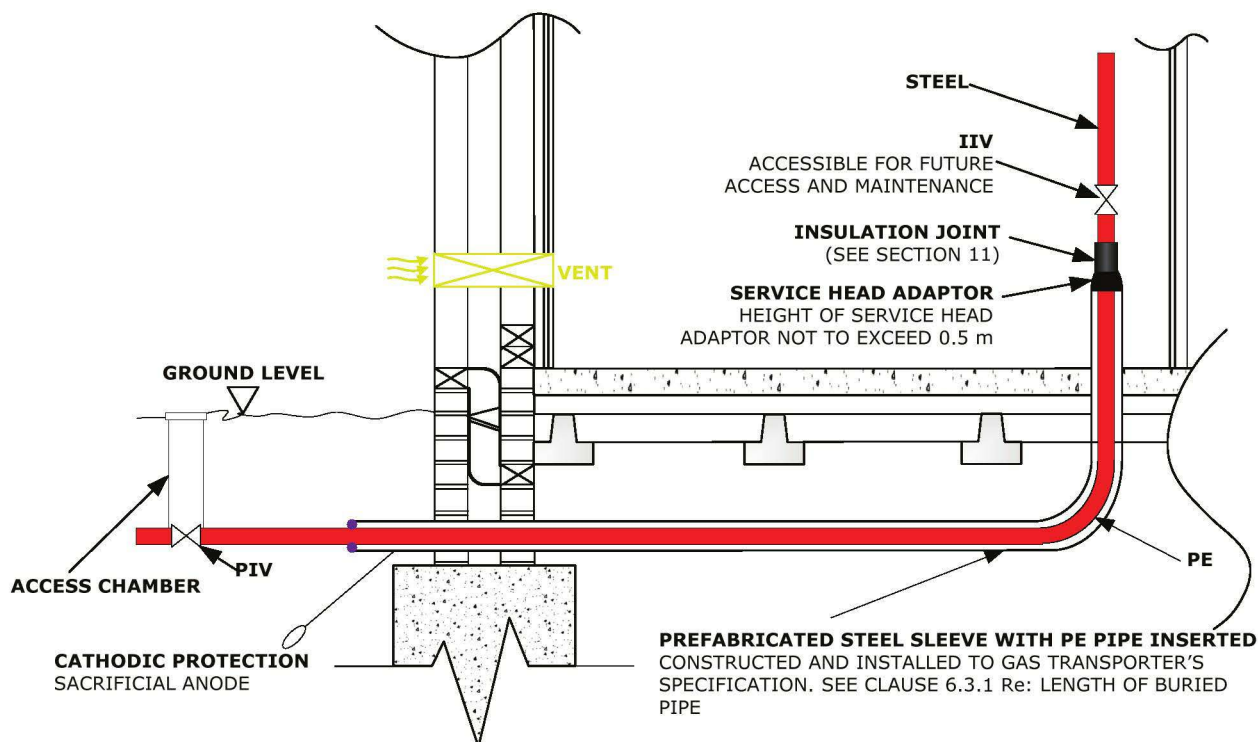


FIGURE 14 - TYPICAL PRE-FABRICATED BELOW-GROUND ENTRY. PE PIPE IN A STEEL SLEEVE

6.3.3 Steel

6.3.3.1

Normally, entry shall be in accordance with the principles of Figure 15, in which welded steel laid within a impermeable/non-perforated sleeve is placed in a sand-filled channel that terminates in a pit (typically 1 m by 1 m) large enough for the installer to work safely and which allows adequate space for jointing and access for future maintenance.

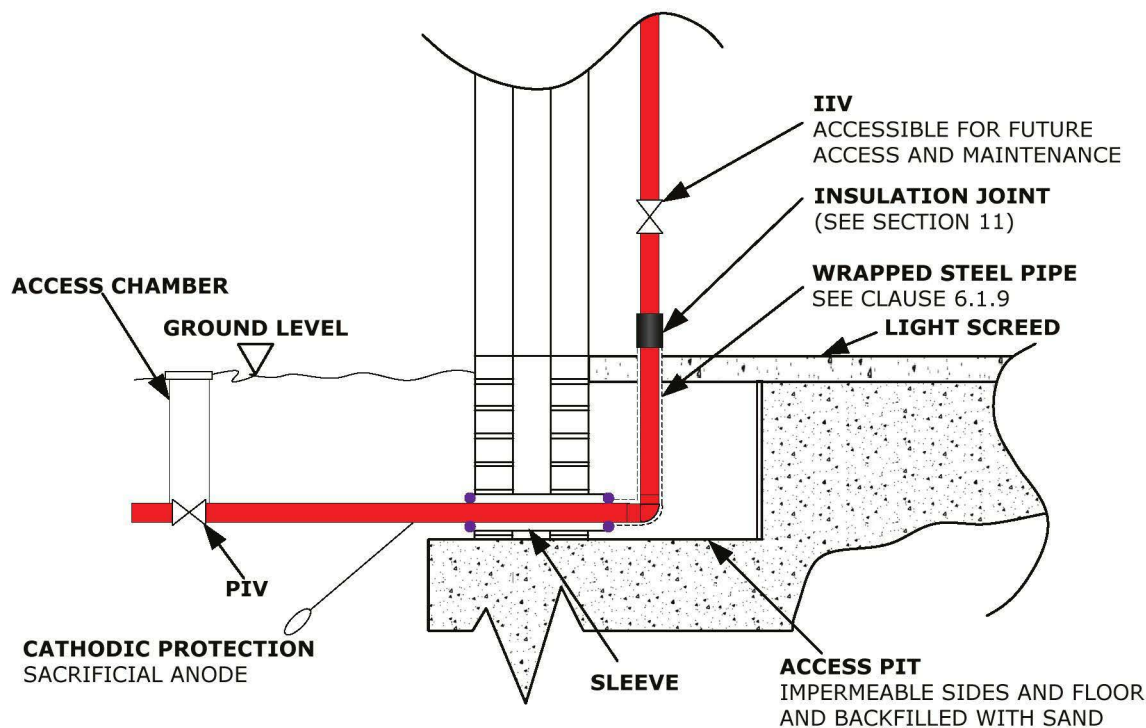


FIGURE 15 - TYPICAL BELOW-GROUND ENTRY. STEEL PIPE IN A SLEEVE

- 6.3.3.2 Alternative permitted below-ground entry methods include cellar (basement) entry fittings (see Figure 16). Such fittings shall be used only where the cellar or basement is adequately ventilated directly to outside air.

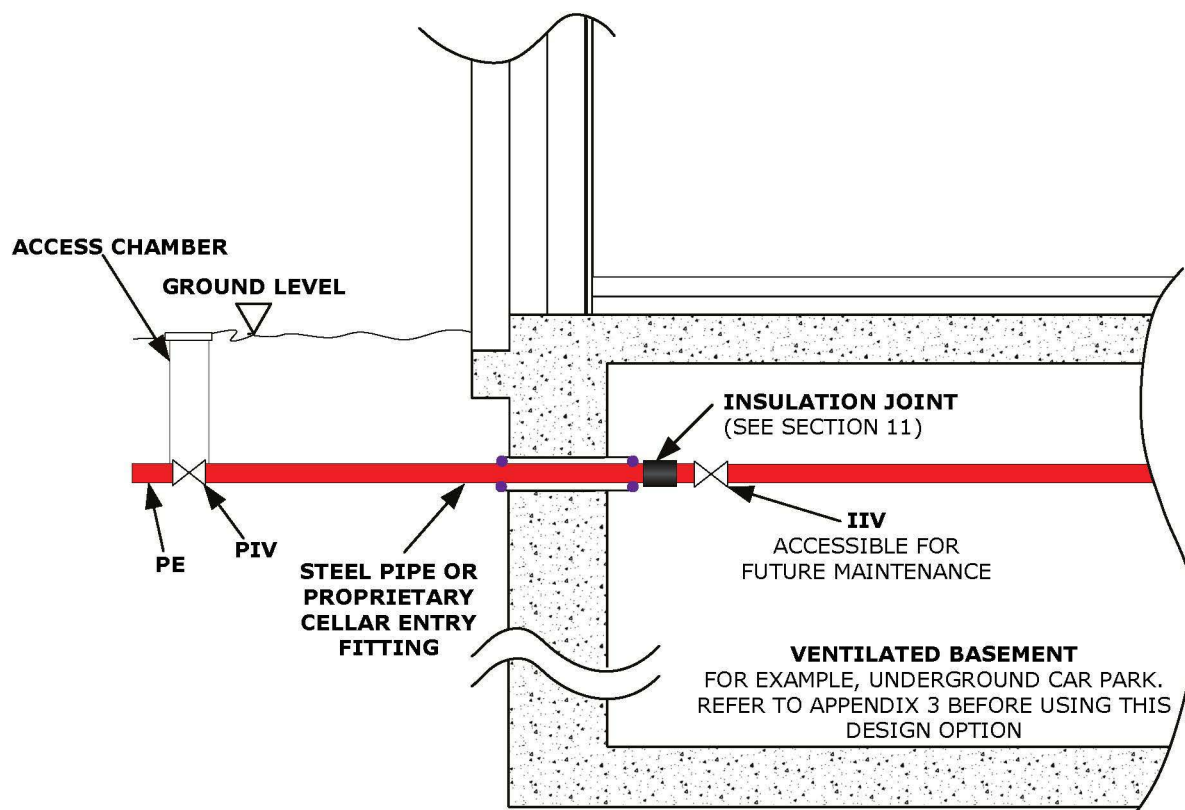


FIGURE 16 - TYPICAL ALTERNATIVE BELOW-GROUND ENTRY. STEEL PIPE. CELLAR/BASEMENT

6.4 RISERS AND LATERALS

6.4.1 General

- 6.4.1.1 The following shall be taken into account when planning network pipeline risers and laterals:

- the proposed location of gas meters
- the proposed location and specification of ventilation ducts for pipeline risers and laterals
- the proposed location of all services, for example installation pipework, electricity, water, telecom, fire, soil and vent pipes, when reference should be made to IGEM/UP/2 and BS 8313
- ventilation requirements
- the provision for relative movement between pipes and building, for example thermal expansion and contraction, shrinkage in timber frame constructions (see Appendix 6) etc.

Note: An allowance needs to be made for shrinkage of timber framing around lateral pipes and thermal movement. Wall cover plates are one method (see Figure 24).

- Building Regulations and standards for the appropriate area
- PSR Regulation 5 (Design of pipeline), Regulation 7 (Access for examination and maintenance) and Regulation 13 (Maintenance)
- suitable and sufficient access to enable the installer to make joints safely
- space requirements for expansion joints, flexible metallic hoses and unrestrained laterals.

- 6.4.1.2 Network pipelines shall be suitably located, supported and protected against undue risk from accidental damage, tampering and vandalism.

NOMINAL BORE (mm)	MAXIMUM UNSUPPORTED LENGTH (m)				
	Screwed steel horizontal	Screwed steel vertical	Welded steel horizontal	Welded steel vertical	External PE
15	2.0	2.5	2.5	3.1	See Note
20	2.5	3.1	2.5	3.1	
25	2.5	3.1	3.0	3.7	
32	2.7	3.3	3.0	3.7	
40	3.0	3.7	3.5	4.3	
50	3.0	3.7	4.0	5.0	
65			4.5	5.6	
80			5.5	6.8	
100			6.0	7.5	
150			7.0	8.7	
200			8.5	10.6	
250			9.0	11.2	

Note: For proprietary systems (e.g. external PE riser systems), see the manufacturer's instructions.

TABLE 6 - SUPPORTING ABOVE-GROUND NETWORK PIPELINES

- 6.4.1.3 Internal network pipeline risers and laterals shall be constructed in steel.

Note: Pliable corrugated tubing is not permitted for pipelines.

- 6.4.1.4 The materials of construction shall be chosen to take account of the environment and any potential hazard in the particular location.

- 6.4.1.5 Materials shall be inherently resistant to corrosion or be suitably protected against corrosion.

- 6.4.1.6 Above ground steel network pipelines shall be protected against corrosion. This should be achieved by the use of either an all-galvanised pipework system or a paint system that complies with BS EN ISO 12944.

Note: BS EN ISO 12944 gives environmental categories C1 –C5 dependent upon the location of the pipework, for example:

- *pipes within habitable buildings, Category C2*
- *pipes within unheated external housings, Category C3*
- *external pipes, Category C5.*

The party responsible for protecting the network pipeline against corrosion shall obtain painting specifications from the manufacturer of the proposed paint system to suit the category.

Note: Painting specifications vary from product to product.

- 6.4.1.7 Any lateral should be as short as practicable.

- 6.4.1.8 Any lateral serving an individual dwelling and exceeding 2 m in length within the dwelling should:

- not contain any joints, or
- be all welded

until connection to an ECV.

6.4.2 **Design - external network pipelines (see Figure 17)**

6.4.2.1 Corrosion-resistant fasteners, appropriate to the external surface of the building, shall be selected to suit the design life of the installation.

6.4.2.2 The design shall tolerate a range of temperatures that will depend on the location and orientation of the building.

Note: In the United Kingdom (UK), allowance for a maximum annual surface temperature variation of 80°C is recommended.

6.4.2.3 Entry of a lateral through an external wall shall be by means of an appropriate method, incorporating a properly supported sleeve with the hole appropriately sealed.

6.4.2.4 Any PE pipe shall be completely sleeved with fire resistant glass reinforced plastic and secured with wall-mounted retaining clips or as instructed by the manufacturer of any proprietary systems.

Note: Special support may be required to resist the natural curvature of coiled pipe.

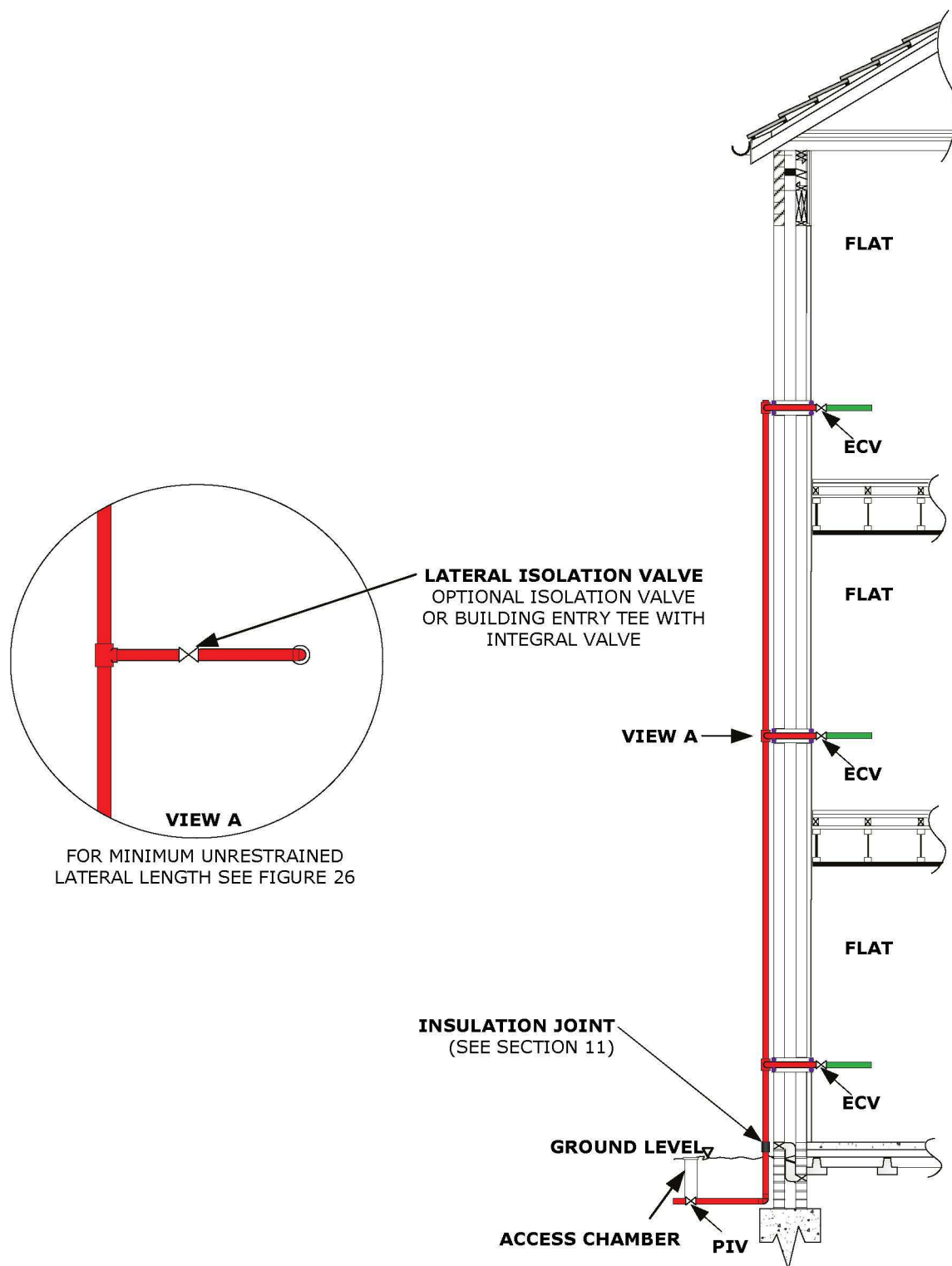
6.4.2.5 Where there is a risk of mechanical damage or vandalism, pipework at less than 3 m from the ground shall be constructed of steel unless a separate means of preventing mechanical damage is provided.

Note: Such means may include providing a rebate in brickwork, additional metal sleeving or guarding.

6.4.2.6 Any additional sleeving or other protection, as required under clause 6.4.2.5, shall be designed to permit the resultant enclosed space to be adequately ventilated, drained and maintained.

The enclosed space shall not contain any other service or cables unless adequate spacing is provided.

6.4.2.7 For an enclosed external riser, ventilation shall be in accordance with the procedures for enclosed internal risers (see clause 6.4.3).



Note 1: A PE riser would have to be enclosed and would not require an insulation joint (see Figure 13).

Note 2: There is no maximum height for a PE riser/lateral system.

**FIGURE 17 - EXTERNAL STEEL OR PE NETWORK PIPELINE.
CONVENTIONAL BUILDING CONSTRUCTION**

6.4.3 Design - internal network pipelines

- 6.4.3.1 Ventilation shall be provided to prevent gas leaks causing the atmosphere to become unsafe.

Note: The levels of ventilation given are not intended to clear any major gas escape arising from catastrophic damage or failure of a gas pipe.

- 6.4.3.2 Ventilation shall be natural. Mechanical ventilation shall not be used to achieve the required ventilation levels.

Note: Where appropriate, ventilation requirements may be determined from first principles in accordance with BS 5925 and IGEM/SR/25.

- 6.4.3.3 Any common stairwell, or other protected shaft, containing a network pipeline that is itself not contained in a sealed duct ventilated directly to outside, shall be ventilated directly to outside air (see Figures 18 and 19).

Note: For the purposes of this Standard, stairwells, or other shafts having well distributed (i.e. without any stagnant or dead areas) ventilation above 0.5 air changes per hour are normally deemed to be adequately ventilated.

- 6.4.3.4 Any network pipeline incorporating a screwed, flanged or other joint capable of developing a leak (excluding a screwed joint on the inlet of an ECV that is located within an individual dwelling) shall be ventilated directly to outside air (see Figure 20).

Note 1: For the replacement of existing installations see clause 2.3 and Sub-Section 4.2.

Note 2: A risk assessment will include consideration of issues such as accessibility for inspection and maintenance, build up/dispersion of gas from joint leakage, detection of that leakage and in the case of replacement activity welding within occupied dwellings.

- 6.4.3.5 Any network pipeline of all-welded construction or any continuous steel pipe without joints shall be ventilated either directly to outside air, or indirectly to outside air via an area that is normally-occupied (see Figures 21 and 22).

Note 1: For the purposes of this clause the term normally-occupied means an individual dwelling or an area in which it is reasonably expected that passers-by will be in the vicinity e.g. regularly used common corridors or common lobbies.

Note 2: Welded pipelines may be ventilated either directly or indirectly to outside. See clause 6.4.3.4 for pipelines containing joints which are capable of developing a leak (e.g. screwed or flanged).

- 6.4.3.6 Irrespective of whether ventilation is directly or indirectly to outside air, adequate ventilation shall be provided within each area, duct, fire compartment or other area.

Note: It is preferred, where practicable, for ventilation to be distributed at high and low level. For ducts see Table 7. The principles of IGEM/UP/2 and BS 8313 can be applied for ceiling spaces.

- 6.4.3.7 Any vertical duct containing a pipeline shall be ventilated at high and low level and should be at least to the levels given in Table 7.

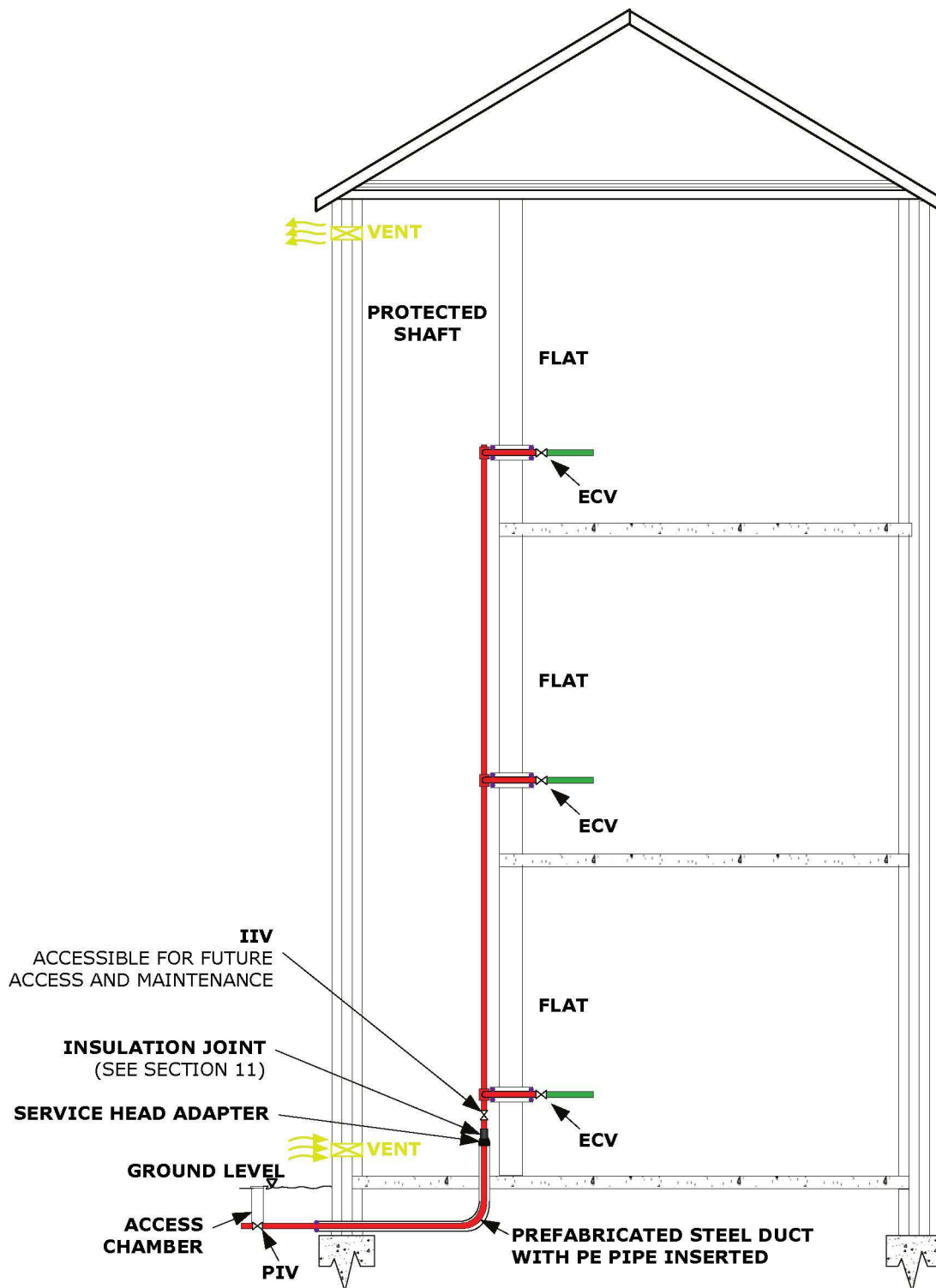
CROSS SECTIONAL AREA (CSA) OF PIPELINE DUCT (m ²)	MINIMUM FREE AREA OF EACH HIGH AND LOW LEVEL VENTILATION OPENING (VENTILATOR) (m ²)	EXAMPLE AIR DUCT SIZE (mm)	EXAMPLE VENTILATOR SIZE (mm)
≤ 0.01	0.002	Ø 50	Ø 70
> 0.01 ≤ 0.375	0.0075	Ø 100	100 x 100
> 0.375 ≤ 0.5	0.0175	Ø 150	100 x 200
> 0.5 ≤ 7.5	0.05	200 x 250	200 x 100
> 7.5	1/150th CSA of the duct		

Note 1: Where the CSA of the duct varies along its length, the largest CSA will need to be used to calculate the required ventilation.

Note 2: CSA is measured perpendicular to the length.

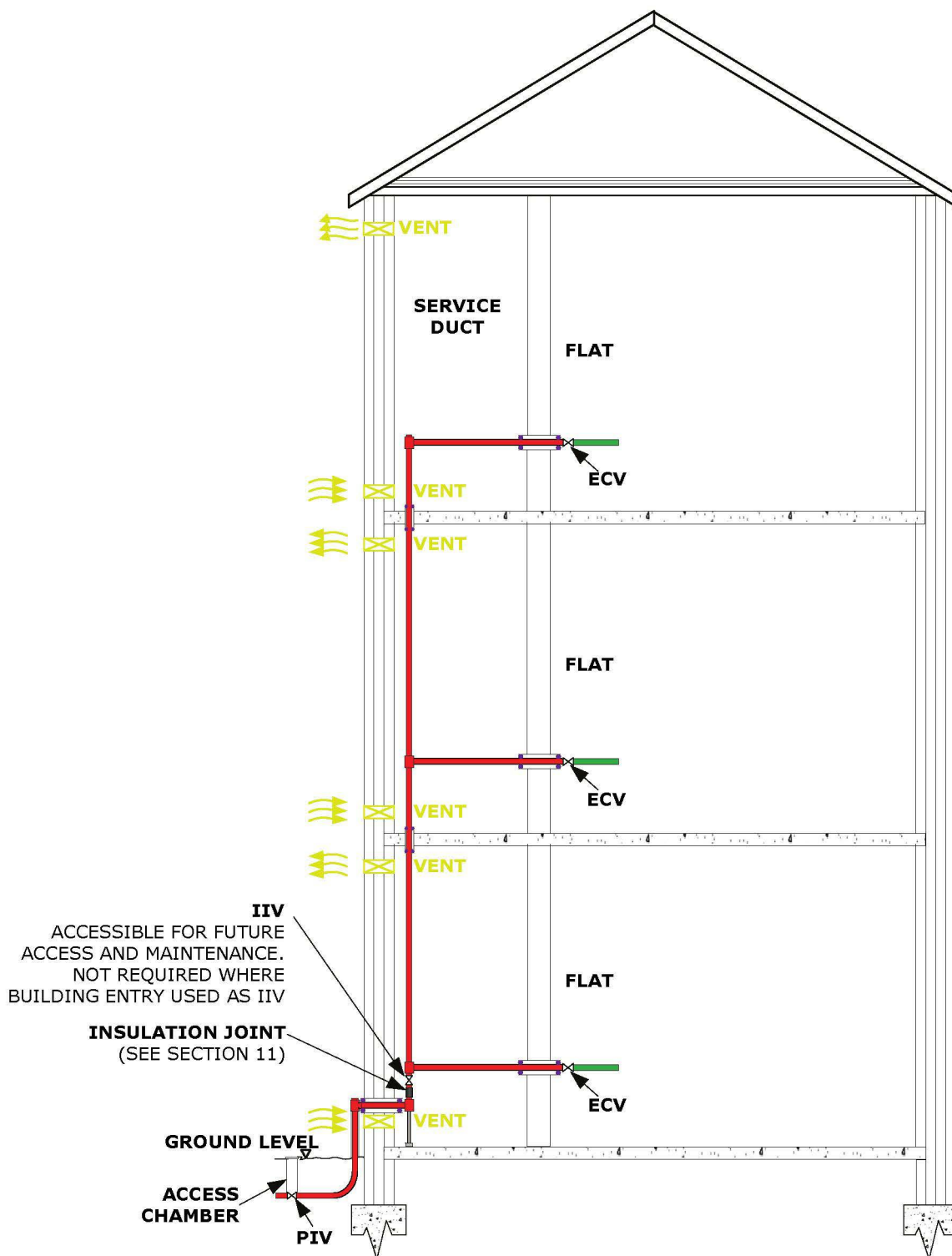
TABLE 7 - VENTILATION FOR VERTICAL DUCTS CONTAINING A NETWORK PIPELINE

- 6.4.3.8 The provision of ventilation should be via permanent ventilators within the area/duct containing pipework (see Figures 18, 19, 20, 21 and 22). Where ventilation is not to be provided in this way, i.e. where it is via dedicated ducts, this Standard does not address such designs in detail and specialist advice shall be sought (see BS 5925 and IGEM/SR/25).



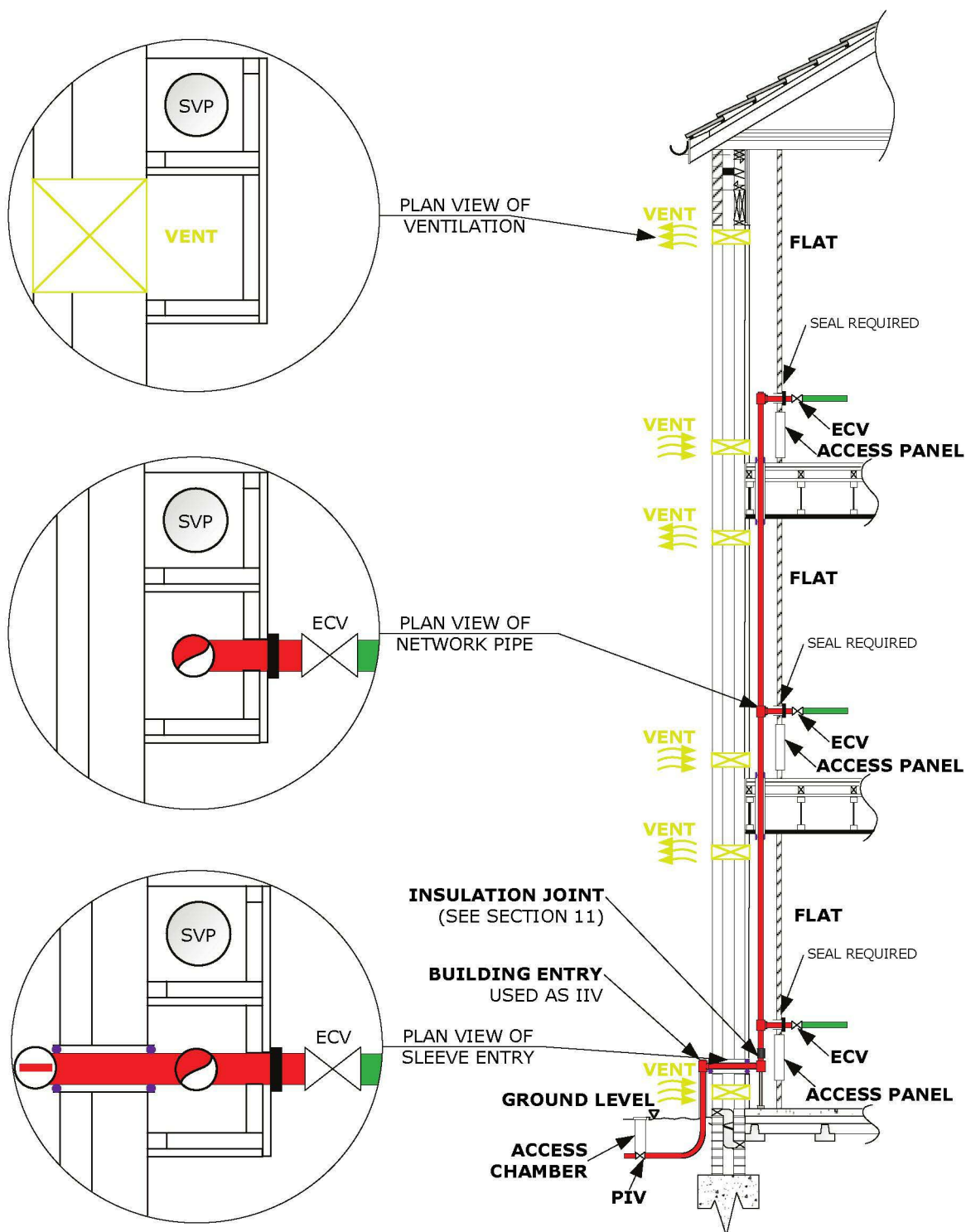
Note: Reference needs to be made to clause 4.2.1.4.

FIGURE 18 - INTERNAL SCREWED OR WELDED NETWORK PIPELINE. PASSING THROUGH A PROTECTED SHAFT (ON AN OUTSIDE WALL). VENTILATED DIRECTLY TO OUTSIDE AIR



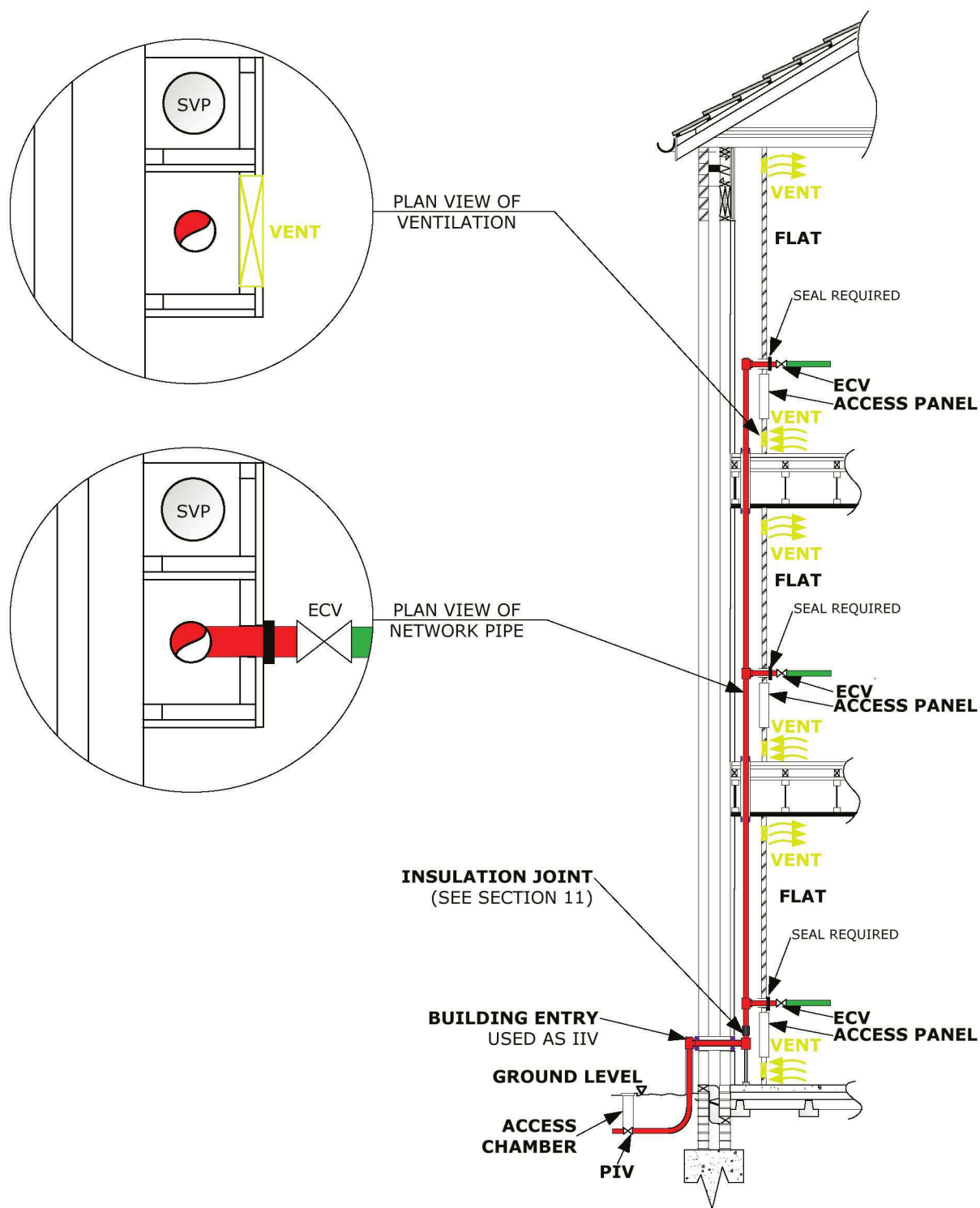
Note: Reference needs to be made to clause 4.2.1.4.

FIGURE 19 - INTERNAL SCREWED OR WELDED NETWORK PIPELINE. PASSING THROUGH A SERVICE DUCT (ON AN OUTSIDE WALL) WHICH IS FIRE STOPPED AT EACH LEVEL. VENTILATED DIRECTLY TO OUTSIDE AIR AT EACH LEVEL



Note: Reference needs to be made to clause 4.2.1.4.

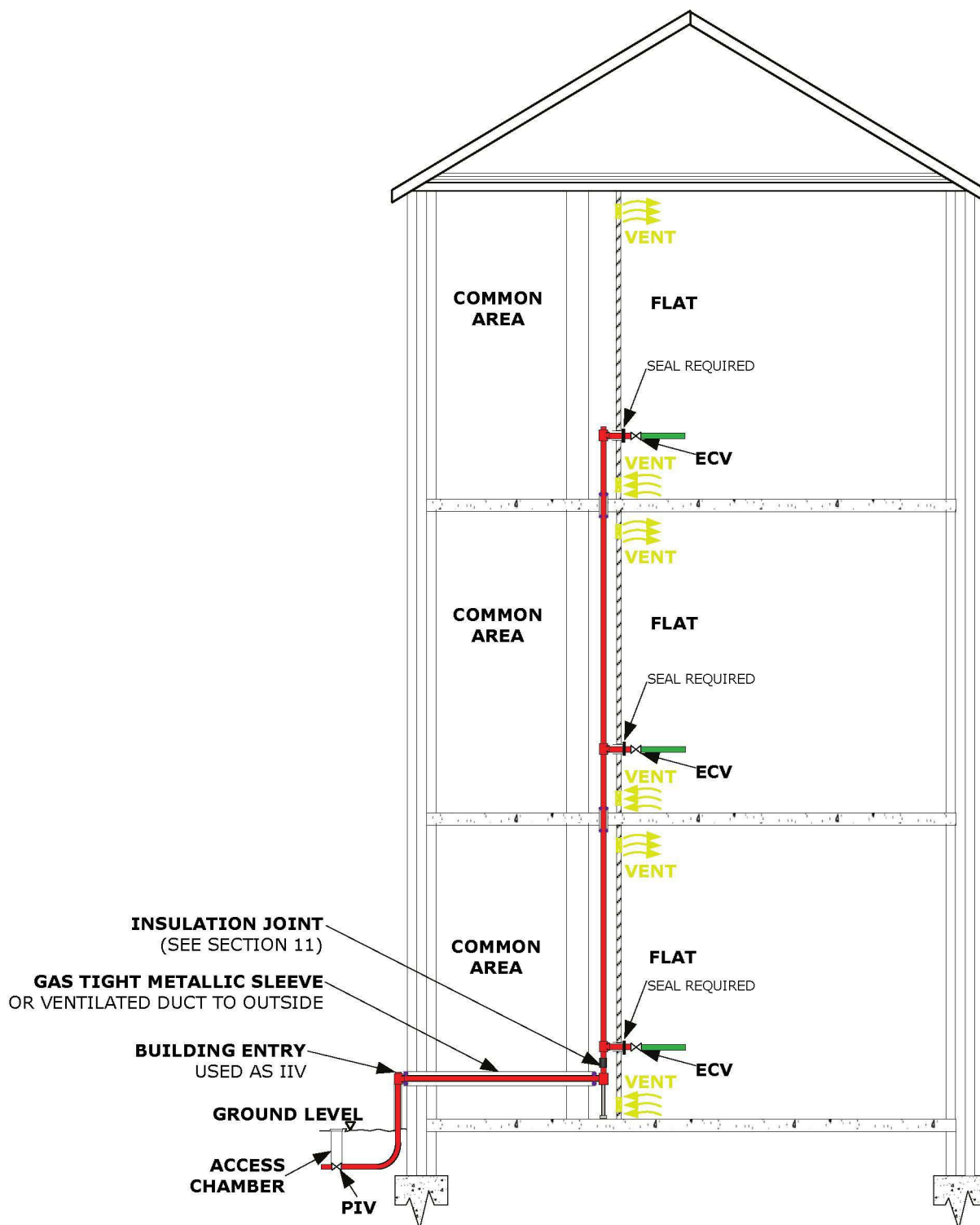
FIGURE 20 - INTERNAL SCREWED OR WELDED NETWORK PIPELINE IN AN ENCLOSURE (ON AN OUTSIDE WALL) WHICH IS FIRE STOPPED AT EACH LEVEL. VENTILATED DIRECTLY TO OUTSIDE AIR AT EACH LEVEL



Note 1: Reference needs to be made to clause 4.2.1.4.

Note 2: Indirect ventilation is only permitted for all-welded network Pipelines (see clause 6.4.3.3).

FIGURE 21 - INTERNAL WELDED NETWORK PIPELINE IN AN ENCLOSURE (ON AN OUTSIDE WALL) WHICH IS FIRE STOPPED AT EACH LEVEL. VENTILATED INDIRECTLY TO OUTSIDE AIR VIA DWELLINGS



Note 1: Reference needs to be made to clause 4.2.1.4.

Note 2: The GT will need to have access for inspection and maintenance.

FIGURE 22 - INTERNAL WELDED PIPELINE RISER. PASSING THROUGH DWELLINGS ON AN INTERNAL WALL. VENTILATED INDIRECTLY TO OUTSIDE AIR VIA THE DWELLINGS. PIPE IN A SLEEVE WHILE IN A COMMON AREA

- 6.4.3.9 Any pipeline riser or lateral shall be sleeved where it passes through any element, for example floor or wall, of a building (see Figure 23).

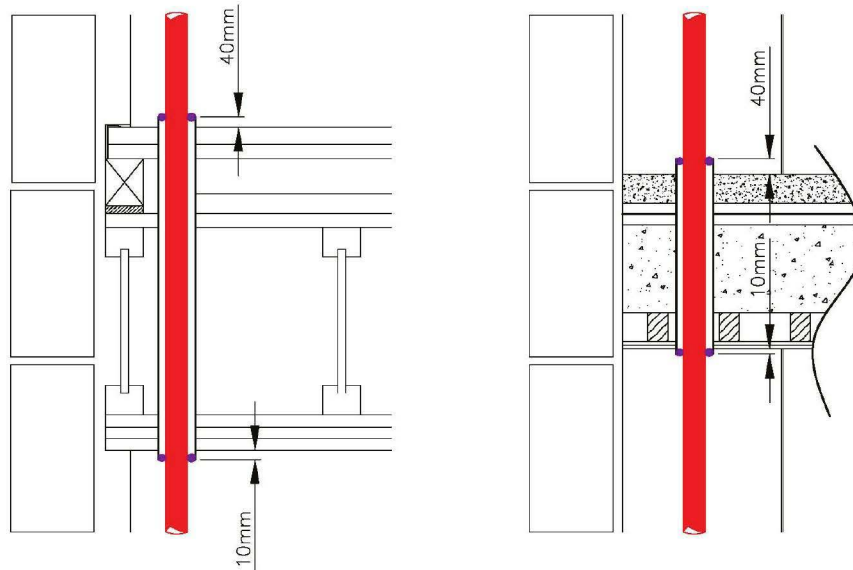
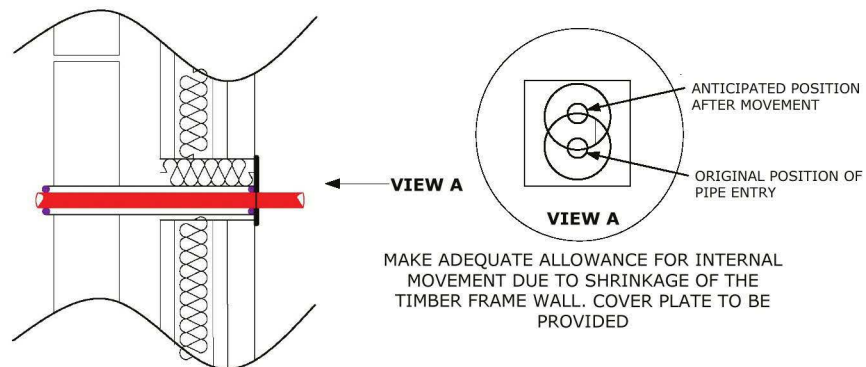
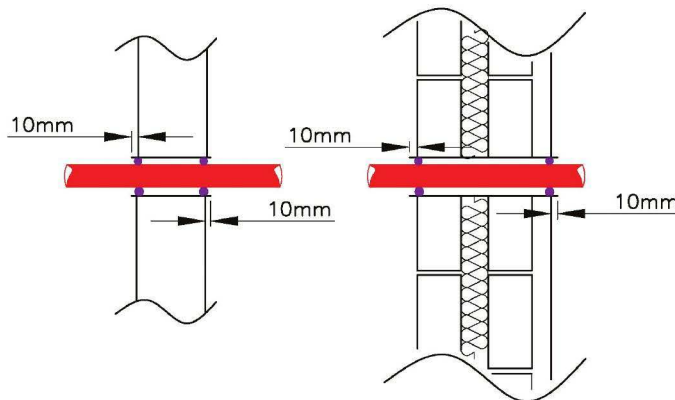


FIGURE 23 - FIRE STOPPING AND SLEEVING. PIPELINE RISER BETWEEN FLOORS OR BETWEEN FIRE COMPARTMENTS

- 6.4.3.10 Any pipeline riser or lateral (or its duct if fitted) shall be fire stopped between fire compartments. The method should permit thermal movement of pipe (see Figure 24).



(a) **Timber frame**



(b) **Single skin**

(c) **Cavity wall**

FIGURE 24 - FIRE STOPPING AND SLEEVING. PIPELINE LATERAL PASSING THROUGH WALLS OR BETWEEN FIRE COMPARTMENTS

- 6.4.3.11 The design shall tolerate a range of temperatures that will depend on the use of the building. In calculating the effects of thermal expansion, due regard shall be paid to the ambient temperature at the time of construction.

Note: In the UK, allowance for a maximum annual temperature variation of 30°C is recommended.

- 6.4.3.12 Pipes may run in the same duct as most other services, including hot and cold water services, heating pipes, electrical conduits, soil and vent pipes (SVP), cables and pipes containing other fuels. However, there are some restrictions and, where pipes are to be routed in combination with other services, reference shall be made to BS 8313, where detailed guidance is given on spacing, provision for maintenance and restrictions on combinations of services etc.

In particular, the following services shall not be installed in the same duct as gas pipes:

- ventilation ducts and vacuum pipes that operate at sub-atmospheric pressure and that are not of all welded or all brazed construction
- services containing oxidising or corrosive fluids.

Note: BS 8313 requires flammable gases and liquids to be run in ducts reserved solely for that purpose or in ducts containing other flammable gases or liquids, cold water or group 4 substances. However they be run in the same duct as any other service(s) if adequate precautions are taken to ensure that the combined installation is safe and that it does not contravene any Regulations or other Codes of Practice.

Following this standard satisfies the level of adequate precautions necessary to allow a combined installation.

- 6.4.3.13 Where a door or access panel is fitted to a duct (including those that are protected shafts) containing a pipeline riser or lateral, the door must comply with Building Regulation requirements and permit access to the GT when required (see also, clause 4.4.2).

- 6.4.3.14 Unless pipes are separated by electrical insulating material, they shall be suitably spaced from other services. Electricity supply and distribution cables and other metallic services shall be spaced at least 25 mm from any pipework. A minimum clearance of 150 mm shall be provided from electricity meters and other devices, such as excess current control devices and fuse boxes.

Note: Spacing will probably need to be increased in order that maintenance and inspection can be carried out easily, and without damaging services or their protective wrappings/coatings and without hazard to personnel.

6.4.4 Jointing and flexibility

- 6.4.4.1 Steel network pipelines of diameter exceeding 50 mm shall be welded.

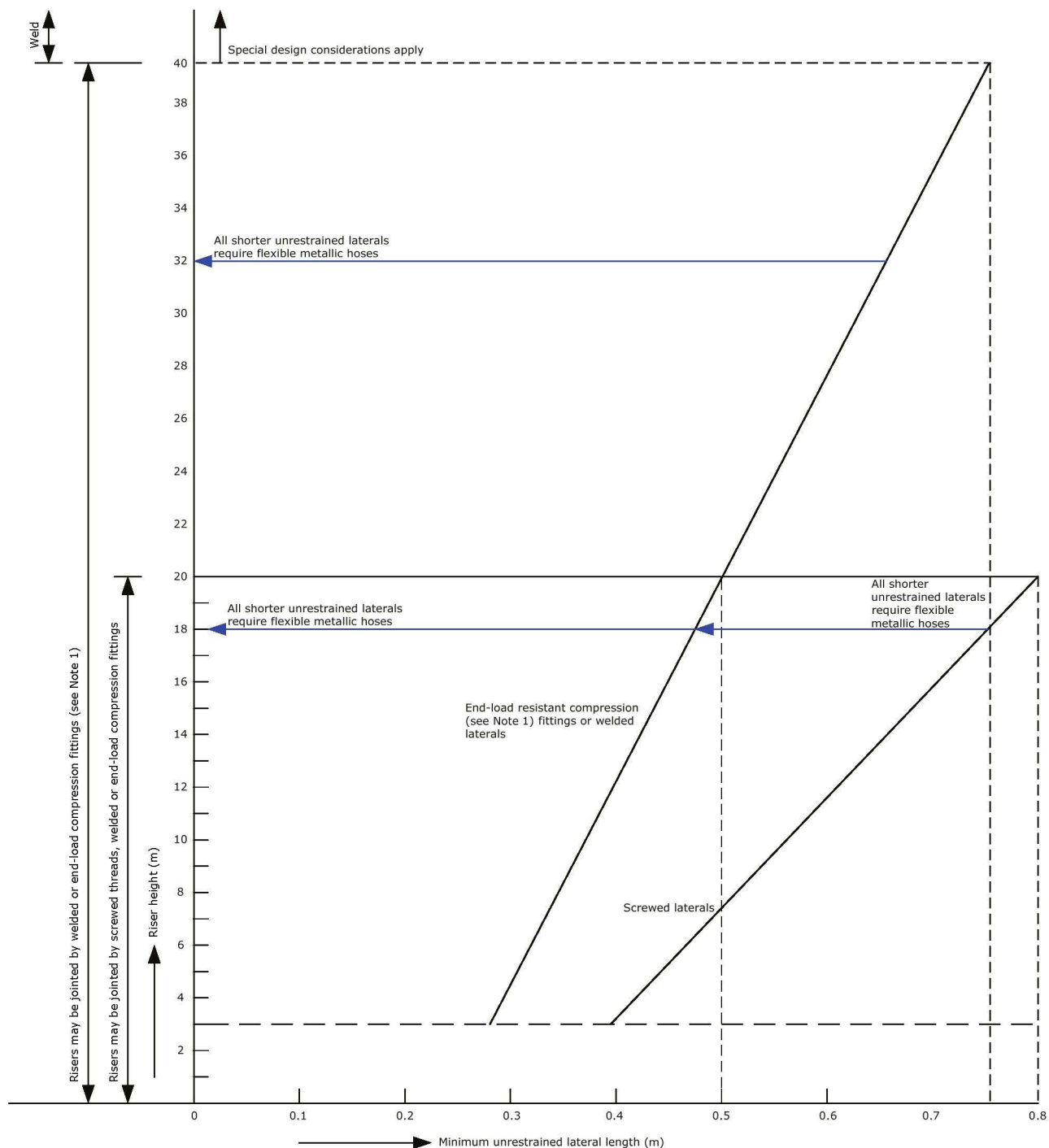
- 6.4.4.2 Steel network pipeline sections of diameter not exceeding or equal to 50 mm shall be jointed as shown in Table 8.

PIPELINE LENGTH (m)	STEEL PIPE DIAMETER ≤ 50 mm (2 in)
≤ 20	Screwed, or end load resistant fittings or welded (see Note),
> 20 ≤ 40	End load resistant fittings, or Welded (see Note)
> 40	Welded

Note: In general, welded joints are preferred as, particularly for internal applications, they serve to enhance safety and generally to minimise future nuisance escapes. In any event, welding may be required under clause 6.4.3.

TABLE 8 - PERMISSIBLE JOINT TYPES IN STEEL NETWORK PIPELINES

- 6.4.4.3 For welded joints, materials shall be in accordance with IGE/TD/3 or IGE/TD/4, as appropriate. Welding shall be in accordance with Table 2.
- 6.4.4.4 For screwed joints heavy grade steel tube to BS EN 10255 (or equivalent) with taper/parallel screwed and socketed threaded joints to BS EN 10226-1 shall be used.
- Note: Pipework systems may not contain a mixture of different types of threaded joint. Taper/parallel (EN 10226-1) and taper/taper (EN 10226-2) jointing systems may not be used in the same installation.*
- 6.4.4.5 End load resistant fittings shall be fire resistant and shall be approved by the GT. Tube shall be either heavy or medium grade BS EN 10255 (or equivalent).
- 6.4.4.6 Threads shall be sealed with an appropriate sealant, for example conforming to BS 6956-5, or an appropriate gas tape to BS EN 751-3.
- 6.4.4.7 If a metallic hose assembly is used, it shall comply with BS EN ISO 10380 (flexibility type 1 or 2) and shall be fitted in accordance with BS 6501-1 or to the manufacturer's instructions, as appropriate.
- Note: A flexible connection may be required to avoid unacceptable stresses being inflicted on a steel lateral by thermal expansion of either the riser or the lateral.*
- Pliable hose assemblies designed as meter connections i.e. conforming to BS EN ISO 10380 (flexibility type 3) or PRS/6E shall not be used.
- 6.4.4.8 If a pipe is subjected to bending, consideration shall be given to the need for flexible metallic hoses to reduce the resulting stresses calculated (see also Figures 25 and 26).
- 6.4.4.9 The number of joints in any pipeline riser or lateral should be minimised. Prior to jointing, all threads shall be checked for damage.
- 6.4.4.10 Electrical safety measures, including any equipotential bonding, shall be taken in accordance with Section 11.



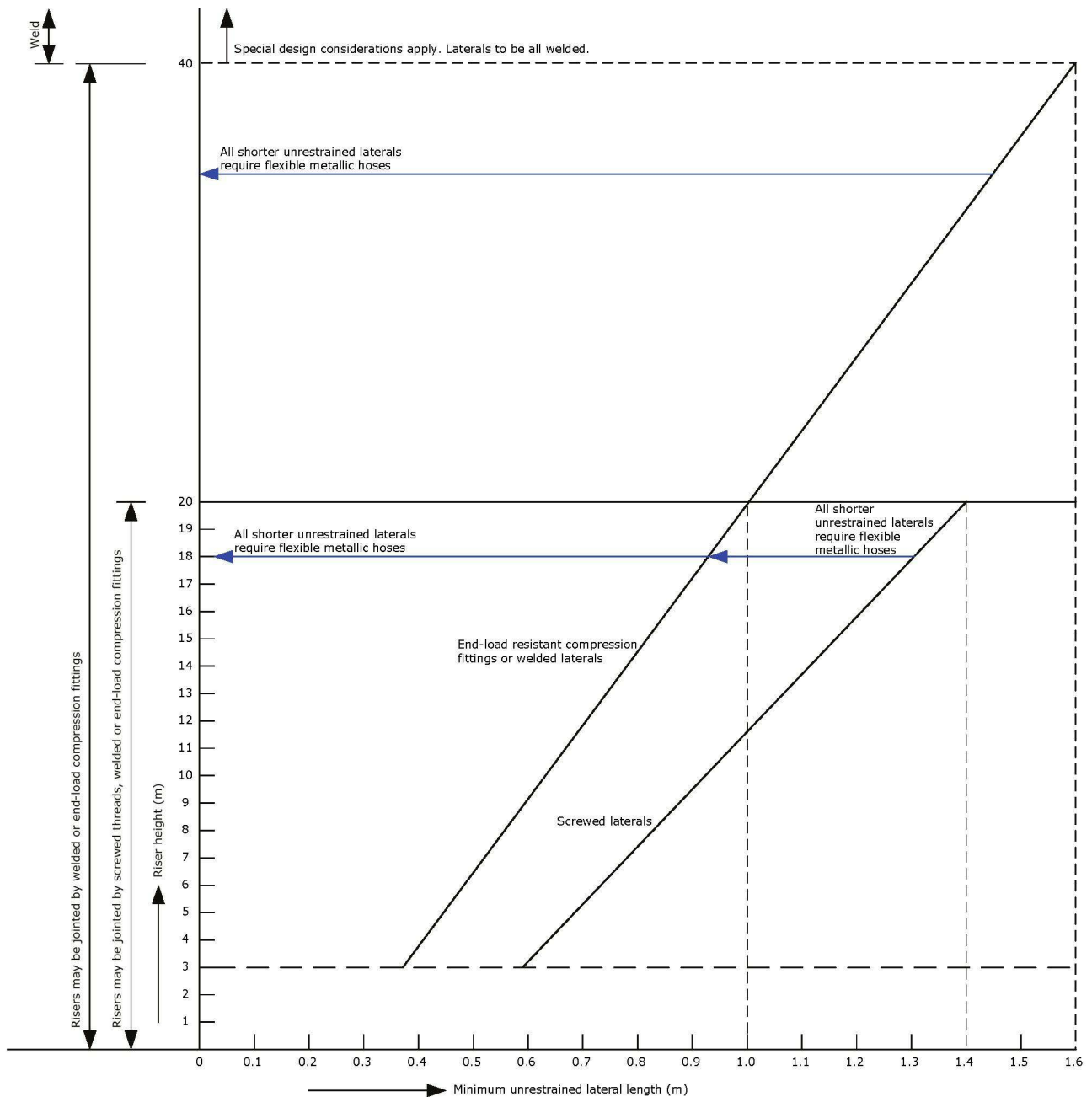
Note 1: Compression fittings are not permitted within common means of escape such as stairwells, corridors and foyers.

Note 2: Assumes thermal expansion of steel to BS EN 1337.

Note 3: This graph applies to laterals of maximum nominal diameter 25 mm.

Note 4: This graph is based on research carried out by the British Gas Engineering Research Station (see A2.9, 'ERS R4088').

FIGURE 25 - USING UNRESTRAINED LATERALS TO ACCOMMODATE THERMAL EXPANSION AND CONTRACTION. INTERNAL STEEL NETWORK PIPELINES



Note 1: Assumes thermal expansion of steel to BS EN 1337.

Note 2: This graph applies to laterals of maximum nominal diameter 25 mm.

Note 3: This graph is based on research carried out by the British Gas Engineering Research Station (see A2.9, 'ERS R3845').

FIGURE 26 - USING UNRESTRAINED LATERALS TO ACCOMMODATE THERMAL EXPANSION AND CONTRACTION. EXTERNAL STEEL NETWORK PIPELINE

SECTION 7 : ISOLATION VALVES FOR NETWORK PIPELINES, METER INSTALLATIONS AND INSTALLATION PIPEWORK

Valves enable parts of gas supply systems to be safely isolated from the upstream system.

7.1 GENERAL

7.1.1 Isolation valves shall be provided to permit the following to be achieved:

- stopping of existing gas escapes, thus minimising the possibility of explosion and fire (or further explosion and fire)
- removal of the possibility of gas escapes in circumstances where conditions are unknown
- removal of the possibility of other gas-related emergencies, for example carbon monoxide (CO) poisoning
- removal of the possibility of gas escapes when a building, or a part of it, is unoccupied or ceases to use gas
- carrying out of alterations and maintenance in gas-free conditions.

7.1.2 Isolation valves shall be installed in accordance with IGE/TD/3, IGE/TD/4, BS 6400, IGEM/GM/6, IGE/GM/8, BS 6891 and IGEM/UP/2 as appropriate.

7.2 KEY HOLDING

7.2.1 The GT or other gas conveyor and the ESP shall hold valve keys to all relevant valves upstream of any primary meter.

7.2.2 The landlord or agent shall hold keys to locked areas containing gas isolation valves of any description. They shall not hold gas valve keys that permit the valves to be operated unless they are competent (see clause 3.5.1) to make safe and restore gas supplies.

7.2.3 Gas consumers must be provided with keys to any locked area containing an ECV supplying their dwelling.

7.2.4 A sign should be placed in a prominent position to advise the appropriate party (GT/ESP/Gas Conveyor/MAM/consumer/meter reader) where the keys to any locked area containing isolation valves may be found.

7.3 PIPELINE ISOLATION VALVE (PIV)

7.3.1 Where a network pipeline supplies a multi-occupancy building, a PIV shall be installed outside the building to enable isolation of the building complex.

Note 1: A service supplying only one or more external individual domestic meter boxes does not require a PIV.

Note 2: A house or building entry tee with an integral valve is not permitted to serve as a PIV.

7.3.2 Any PIV shall be of a type that can be operated by a key held by the GT/gas conveyor and the ESP. The design or position of the valve shall resist efforts by persons who are not competent to restore gas supplies, such as building occupants or members of the public to operate it with standard tools.

Note: For example, the valve may be installed underground.

7.3.3 Any PIV shall be protected with a valve cover and shall be permanently identified.

Note: A valve cover embossed with the word "Gas", or otherwise permanently marked, or secure and permanent wall-mounted labels, are considered suitable methods of identification.

7.3.4 The location of the PIV shall permit access to it in normal circumstances.

In selecting the location of the PIV:

- it shall be sited as near as is practicable to the boundary of the property
- the effect of a building fire on its operability shall be considered
- it shall not be positioned where vehicles are likely to stop or park.

7.3.5 Subject to the considerations of clause 7.3.4 and with reference to Figure 27, the PIV should be located in the following order of priority:

- in, or in line with, the footway nearest the building (Figure 27, C, F, J, M, N)
- inside the property boundary, but not in planted areas such as borders or hedges (Figure 27, A, D, G)
- elsewhere within the property boundary, preferably at least 5 m from the building (Figure 27, B, E, H)
- where the section of pipeline is long and has been laid in a non-standard orientation, in the two most appropriate positions (using the guidelines above) at both ends of the section of pipeline, so as to indicate the line of the pipeline (Figure 27, K, L).

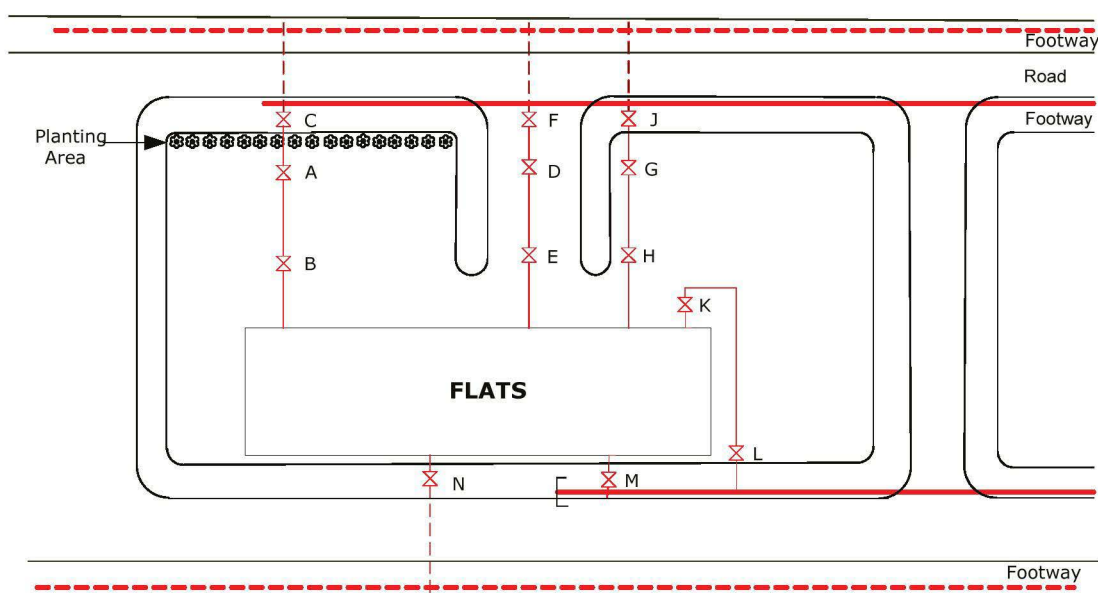


FIGURE 27 - PREFERRED PIV LOCATIONS

7.4 INLET ISOLATION VALVE (IIV)

The IIV enables that part of a building complex being fed by an internal pipeline to be isolated for maintenance or safety reasons.

7.4.1 An IIV shall be located near to the point of entry of a network pipeline into a multi-occupancy building.

7.4.2 Any IIV shall:

- be clearly identified as a gas valve
- resist the efforts of any person not competent to restore gas supplies from re-opening a closed IIV
- be accessible for maintenance purposes
- not be accessible to members of the public

- normally, be located inside the building. Where this is impracticable, consideration shall be given to locating the IIV in a locked outside compartment at the point where the pipeline enters the building
- where there is a low risk of vandalism or misuse, give consideration to enclosing the IIV in a standard gas meter box or equivalent structure
- where vandalism or misuse is considered a possibility, have access to the IIV restricted by means of a locked door or an equivalent device
- have permanent identification and gas escape action notices posted on or near the IIV
- have any other required labelling displayed at the IIV.

7.4.3 Any IIV shall be one of the following:

- an integral valve of a building (house) entry tee, operable only by a special key, or
- when a 90° lever action ball valve is used, it locks shut when operated, or
- require a security key to close and re-open it, or
- when a wheel valve is used, it is locked in the open position or it has the handle removed and secured away from the valve spindle.

7.5 **BRANCH ISOLATION VALVE (BIV)**

7.5.1 Where multiple network pipeline risers or major laterals are controlled by a common IIV, each should be fitted with a branch isolation valve (BIV) to facilitate maintenance. A BIV should be located as near as practicable to the point where the branch is connected to the upstream pipe.

Note 1: BIVs permit the maintenance of individual risers and laterals with the minimum of inconvenience and danger.

Note 2: Where deemed necessary, BIVs may be fitted at any further pipe branches to permit maintenance of those branches with the minimum of inconvenience and danger.

7.5.2 Any BIV shall:

- be clearly identified as a gas valve
- prevent any person not competent nor authorised to restore gas supplies from operating a closed BIV
- be accessible for maintenance purposes
- not be accessible to members of the public
- where vandalism or misuse is considered a possibility, have access to the BIV restricted by means of a locked door or an equivalent device
- have a permanent identification notice posted on or near the BIV
- have any other required labelling displayed at the BIV.

7.5.3 Any IIV shall be one of the following:

- an integral valve of a building (house) entry tee, operable only by a special key, or
- when a 90° lever action ball valve is used, it locks shut when operated, or
- require a security key to close and re-open it, or
- when a wheel valve is used, it is locked in the open position or it has the handle removed and secured away from the valve spindle.

7.5.4 Where an expansion joint is fitted, the BIV should be located upstream of that joint.

- 7.5.5 Where a welded riser has been specified, the introduction of a screwed or flanged BIV, and its inherent propensity to leak, shall be considered and, if appropriate, the BIV should not be fitted or its connection should be by welding.

Note: This is of particular importance if ventilation is not direct to outside.

7.6 LATERAL ISOLATION VALVE (LIV)

- 7.6.1 Where a lateral supplies an individual dwelling, consideration shall be given to the installation of a lateral isolation valve (LIV) for isolation or maintenance purposes.

Note 1: LIVs permit the maintenance of individual laterals with the minimum of inconvenience and danger.

Note 2: LIVs may be of particular value when the gas supply to an individual dwelling has to be isolated. For example, to comply with GS(I&U)R, isolation or service disconnection has to be carried out before a period of 12 months has elapsed since the removal of a primary meter.

- 7.6.2 Any LIV shall be located as near as practicable to the pipe to which the lateral is attached.

- 7.6.3 Any LIV shall meet clauses 7.5.2 to 7.5.5.

7.7 EMERGENCY CONTROL VALVE (ECV) AND ADDITIONAL EMERGENCY CONTROL VALVE (AECV)

- 7.7.1 An ECV shall be installed at the inlet to each individual meter installation.

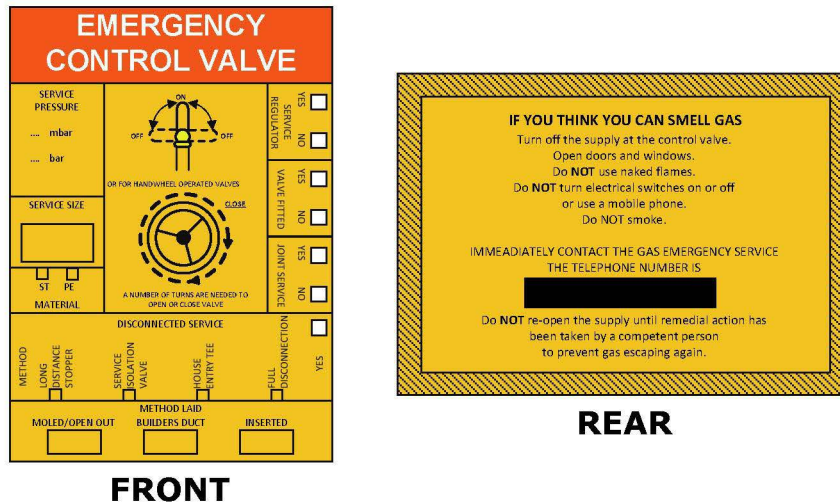
- 7.7.2 The outlet of any ECV shall:

- be either a flanged or threaded connection,
- allow a meter installation to be installed in accordance with BS 6400, IGE/GM/6 or IGE/GM/8, as appropriate
- be of a type acceptable to the GT.

Reference should be made to IGE/TD/4.

- 7.7.3 Any ECV shall be suitable for the network pressure.

- 7.7.4 The key, lever or hand wheel of the ECV should be securely attached to the operating spindle. Any key or lever should move downwards from the vertical ON position to the OFF position. The ON/OFF label or indicator should be fixed to the ECV (see Figure 28), or inlet or outlet pipe, at the time of installation and such that it can easily be seen. The label should be attached so as to correspond to the exact movement of the control.



Minimum dimensions: 105 x 148 mm

Note 1: The label/notice is fitted by the GT.

Note 2: It is not permitted to include this notice in a composite notice.

Note 3: GS(I&U)R and IGEM/G/1 detail the first emergency control as a valve accessible to the consumer, downstream of the distribution main and which marks the interface between the service (pipe) and a meter installation. Where there is no meter installed, the notice satisfies the requirements of GS(I&U)R detailing the status of the incoming supply and advising the number to contact in case of an escape of gas.

Note 4: The use of ON/OFF marker tape is also permitted.

FIGURE 28 - TYPICAL LABEL FOR AN ECV

- 7.7.5 Any ECV must be located so that it will be readily accessible for use by the consumer i.e. the end-user, of gas.
- 7.7.6 An AECV shall be fitted in each individual dwelling where a:
- primary meter installation and the ECV is not located within a dwelling (e.g. in meter banks or individual remote meters)

Note 1: This may be waived where the consumer has ready access to their nearby ECV, for example when a ground floor flat has an outside meter box located near to an external doorway to the flat.

Note 2: BS 6891 recommends an AECV is installed where the meter installation and the ECV is sited 6 m or more from the building/dwelling.

- bulk primary meter installation is situated remote from, or adjacent to, the multiple individual dwellings it serves (see Figure 6, a secondary meter may be fitted after the AECV).

- 7.7.7 Any AECV shall be readily accessible to the consumer and shall be located as near as practicable to the point of entry of the gas supply to the dwelling. This valve will serve to isolate the pipework located within a dwelling.
- 7.7.8 Any ECV or AECV located within an individual dwelling shall not be capable of being locked shut.

7.8 FEATURES OF LOCK-SHUT AND OTHER SECURITY VALVES

7.8.1 General

- 7.8.1.1 Any lock-shut or other security valve shall:
- be clearly identified as a gas valve

- have the open and closed positions of the valve either indicated or obvious, both when any handle is in place and when the valve stem is being accessed for operation with the key or tool
- in the UK, not be able to be operated with standard UK meter box keys
- have a shroud, as indicated in Figure 29, or other means of preventing operation of the valve with conventional tools
- have a stem or recess that is able to be operated with a standard security valve key as shown in Figure 30, or another special tool
- have access to the valve stem restricted by a mechanical barrier. A standard tool shall be required to remove the barrier.

Note: Where desired, the valve may incorporate a "block and bleed" vent between two sealing edges to facilitate any future pipework testing.

7.8.2 Lock-shut valves

- 7.8.2.1 Lock-shut valves are intended to be used for maintenance or safety reasons but not as ECVs.
- 7.8.2.2 The handle of the lock-shut valve shall move through a $\frac{1}{4}$ turn to shut against a stop.
- 7.8.2.3 Where Allen screws are used to secure the mechanical barrier, the Allen key size shall be 2.5 mm.
- 7.8.2.4 Lock-shut valves shall be able to be opened by the use of a standard security valve key.

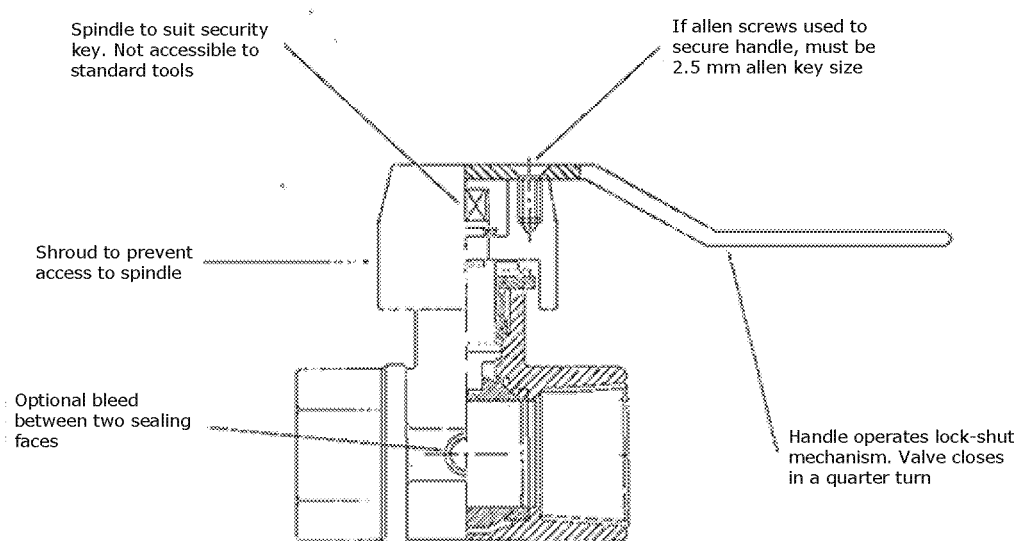


FIGURE 29 - FEATURES OF LOCK-SHUT VALVES

7.8.3 Ball-type security valve

- 7.8.3.1 Ball-type security valves are intended to be used for maintenance or safety reasons but not as ECVs. They shall not be fitted with handles.
- 7.8.3.2 The valve stem shall move through a $\frac{1}{4}$ turn to both shut and open against stops.
- 7.8.3.3 Ball-type security valves shall be able to be re-opened by the use of a standard security valve key.

7.8.4 Standard security valve key

- 7.8.4.1 The standard security valve key is used to operate standard lock-shut and ball-type security valves. It shall be fabricated to the general dimensions and minimum length shown below.

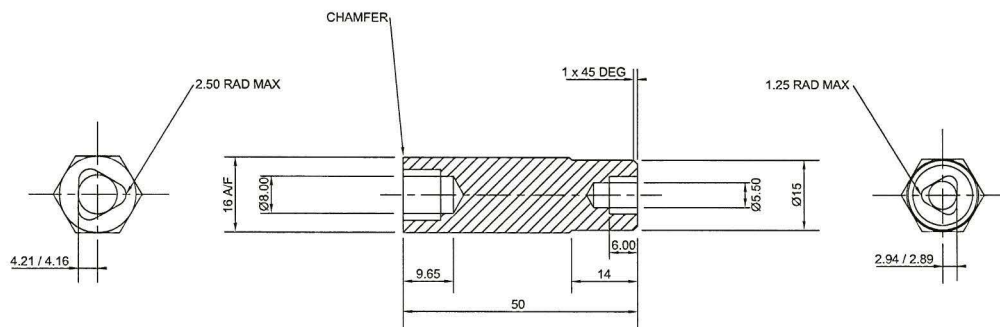


FIGURE 30 - STANDARD SECURITY VALVE KEY

7.8.5 Riser security valve

- 7.8.5.1 An alternative to lock-shut and ball-type security valves is the riser security valve, incorporating an integral shut-off valve. The valve may be used for risers, branches and laterals as appropriate.

Riser security valves are intended to be used for maintenance or safety reasons but not as ECVs.

Access to the integral shut-off valve shall require the prior removal of a secure cap or plug. Removal of the cap or plug and operation of the valve shall require the use of one or more tools.

- 7.8.5.2 If release of gas is possible during the operation of the valve, the operating tool shall incorporate a sealing arrangement to prevent such a release.
- 7.8.5.3 Threaded or weldable riser valves may be available. Both types of fitting shall comply with GIS/PL3 (for stopper and pressure drop requirements) and they shall resist elevated temperature according to DIN 3389-1.
- 7.8.5.4 Threaded fittings shall be made from malleable iron (according to GIS/PL3), and steel weldable fittings shall adhere, where applicable, to GIS/F7.

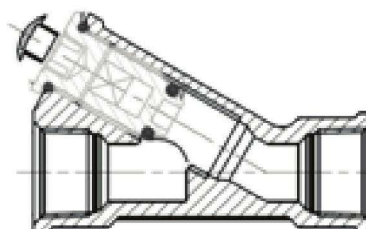


FIGURE 31 - RISER SECURITY VALVE

7.9 OTHER VALVES

7.9.1 Calibrated excess flow valve (EFV)

- 7.9.1.1 As described in Sub-Section 5.2 and Appendix 3, a GT or MAM may determine that calibrated EFVs are to be installed at primary meter installations for safety reasons.

Note: Where fitted, consideration needs to be given to the pressure drop (see clause 4.3.4.2).

Any EFV shall be of proven reliability and shall be specified to meet a recognised national or international standard to the satisfaction of the adopting GT or MAM, even in instances where it may be fitted downstream of the ECV.

- 7.9.1.2 Calibrated EFVs shall be the 'weep reset' type and shall trip at an appropriate flow rate (see Table 11 and A3.5.1).
- 7.9.1.3 The selected EFV shall comply with an appropriate Standard, for example DVGW VP 305-1 (see Table 11).
- 7.9.1.4 Where an EFV is fitted upstream of an ECV, consideration shall be given to installing an upstream maintenance valve to permit the EFV to be exchanged without decommissioning the riser system.

Note: An upstream 'weep reset' EFV will reset automatically once the ECV has been closed.

7.9.2 Thermal cut-off device (TCO)

- 7.9.2.1 As described in Section 5, a GT or MAM may determine that TCOs are to be installed at primary meter installations for safety reasons.

Note: Where fitted, consideration needs to be given to the pressure drop (see clause 4.3.4.2).

Any TCO shall be of proven reliability and shall be specified to meet a recognised national or international standard (see Table 11) to the satisfaction of the adopting GT or MAM, even in instances where it may be fitted downstream of the ECV.

- 7.9.2.2 TCOs shall close within the temperature range stipulated in the accepted standard, typically at values around 100°C.
- 7.9.2.3 The selected TCO shall comply with an appropriate Standard, for example DIN 3586 (see Table 11).
- 7.9.2.4 Where a TCO is to be fitted upstream of an ECV, consideration shall be given to installing an upstream maintenance valve to permit the TCO to be exchanged without decommissioning the riser system.

7.9.3 Butterfly valves

- 7.9.3.1 Butterfly valves shall not be fitted in network pipelines.

SECTION 8 : ENERGY CENTRES

An energy centre is a central facility generating heat or heat and power from a boiler or engine installation. The equipment used is generally industrial or commercial in nature.

8.1 GENERAL

8.1.1 Non-domestic plant and equipment should not be installed in a domestic location where the nature of the installation imposes a risk to the domestic dwellings and their occupants.

8.1.2 The specific hazards, and consequent risks, of a centralised installation of non-domestic plant in a domestic environment shall be identified and managed.

Note: The provision of energy through a centralised installation will have the effect of reducing the scale and scope of the overall gas installation in the building, particularly if there is no provision for cooking. Although, this may reduce the range of hazards involved together with issues around access for inspection and maintenance, any remaining hazards still need to be identified and managed.

8.1.3 An energy centre will be located in a plant room or compound/enclosure; this will not be a part of the building which is in domestic use and will be considered as a place of work with respect to installation, commissioning, inspection and maintenance and hence it will be subject to the requirements of DSEAR. The associated meter installation may be in the same compound/enclosure or preferably in a separate meter compound/enclosure; this will also be subject to DSEAR. The risk assessment shall be carried out by a competent person, be kept up to date, and be available for examination by a regulatory authority.

Note 1: This Standard requires a risk assessment to be carried out on the gas installation see Sub-Section 4.2 and Appendix 3. A risk assessment is also a requirement of DSEAR and of the guidance on the hazardous area classification for downstream gas pipework given in IGEM/UP/16. The specific reference to the installation of a gas booster is due to the hazards of rotating machinery. A booster installation may also incorporate flexible connections. These hazards are recognised in the standard for this equipment, BS 8487, and are leaking seals, and failed castings due to mechanical stress or damage from a loose impeller. Incidents have resulted from these causes and can result in gas release rates in excess of those expected from installations without boosters.

Note 2: The risk assessment described in Sub-Section 4.2 and Appendix 3 includes consideration of the response of the building structure to the range of releases which could occur. IGEM/UP/16 refers, in Sub-Section 4.6, to the risk assessment being carried out with respect to the safety of the structure and of persons. A risk assessment based solely on the low probability of the event will not be acceptable.

Note 3: DSEAR is primarily concerned with the protection of people at work. However, for an installation serving a domestic building, the public will also be affected. Regulation 6 is concerned with the 'Elimination or reduction of risks from dangerous substances'. It refers to the elimination, substitution, or reduction of the dangerous substance, or, where this is not reasonably practicable, to control risks and mitigate the detrimental effects. A priority order of measures to reduce risk is given, and also a list of mitigating measures. The specific requirements are reproduced in Appendix 4.

8.2 LOCATION OF THE INSTALLATION

8.2.1 Consideration of the requirements of DSEAR and of this Standard lead to the need to locate plant rooms and gas supplies for energy centres where they impose a hazard to a minimum number of persons and for the mitigation of the effect of a release of gas which if ignited results in fire or explosion, so as to prevent the consequences significantly affecting the domestic parts of the building. Consideration shall be given to the following:

- (a) Locating plant rooms and meter rooms at ground or rooftop level in a separate (separated or adjoining) compound/enclosure from the domestic building and designing installations to accepted non-domestic installation standards and practice.
- (b) Where there is no alternative to locating the plant room integral with the domestic building, locating it at ground level in an compound/enclosure on an external wall isolated from the rest of the building and with sufficient weak elements in the structure (e.g. access doors, weak panels, windows) to protect the structure in the event of an explosion. Installation in a space not on an external wall will not meet the requirements of this section. Access shall not be possible from domestic areas of the building.
- (c) Where a basement location is proposed, there shall be free access for the relief of any explosion overpressure to the atmosphere (as for a ground level location) via plant access or a freely ventilated car park. The protection of the structure from the pressure which could be generated in an explosion shall be demonstrated in the risk assessment; this is likely to require an area close to that of one side of the compound/enclosure (see Appendix 2.10, 'The investigation and control of gas explosions in buildings and heating plant'). Adequate relief will not be provided by high level ventilation openings or ducts. An installation in an enclosed basement is unlikely to be acceptable (see A3.2.1.3).

Note 1: Option (a) is the preferred, and (c) the least preferred option.

Note 2: An installation within the main structure of the building may result in noise or vibration issues. The solutions to these are likely to compromise the ability to adequately address the safety issues.

Note 3: The allowed maximum operating pressure of the supply into a multi-occupancy building is 75 mbar (see clause 2.7).

8.3 NETWORK PIPELINE ENTRY

- 8.3.1 The requirements of Section 6 shall be met.
- 8.3.2 The network pipeline should enter the meter/plant room directly, it should not pass through any other part of the building.
- 8.3.3 An isolation valve shall be installed as close to the point of entry as practicable, and in any case within 2 m of the entry point.
- 8.3.4 For a rooftop installation, the network pipeline should preferably be external to the building or, if not, in an individual duct sealed from the rest of the building.

8.4 METER INSTALLATION

- 8.4.1 The meter will be of the diaphragm, turbine or rotary displacement type. The installation will also comprise a regulator, isolation valves and, where required, a bypass facility. The meter installation shall conform to IGE/GM/8 or IGEM/GM/6, IGEM/GM/7B and where appropriate, IGEM/GM/7A.

- 8.4.2 The meter room should be secure from unauthorised entry. However, provision must be made for access by an authorised person in the event of an emergency.
- 8.4.3 The meter room shall be naturally ventilated direct to outside air.
- 8.4.4 The requirements of Section 7 of IGE/GM/8 Part 1 and of IGE/GM/8 Part 2 will apply to any meter compound/enclosure.
- 8.4.5 When selecting a gas meter the maximum and minimum capacity of the meter (Q_{\max} and Q_{\min}) shall be considered to ensure the gas usage is accurately captured. As such, a number of factors have to be reviewed by the designers and advised to the GT, MAM and Gas Supplier, which may result in multiple meters being selected.

For designing the meter installation, information concerning the energy centre system shall be provided by the energy centre designer to the MAM and should include:

- the estimated maximum flow rate (which is not necessarily a summation of the total connected load) to ascertain the meters Q_{\max}
- the minimum flow rate anticipated (a realistic assessment and not a zero flow rate) to ascertain the meters Q_{\min}
- the number and type of each unit of plant, their maximum and minimum operating pressures, and, where available, the anticipated load pattern for each
- where necessary, peak flow likely to occur for a short period, infrequently, possibly in excess of the meter's Q_{\max}
- establishing that appliances/plant/equipment will operate satisfactorily when the meter installation provides the minimum pressures.

Note: In GB, for a low pressure meter installation the lowest pressure that would be expected at the outlet of the meter installation under normal operating conditions is 18 mbar (LOP_{mi}). Under abnormal conditions this could be as low as 15 mbar (DmP_{mi}).

8.5 **INSTALLATION PIPEWORK**

- 8.5.1 The pipework from the meter to the appliance isolation valve shall conform to IGE/UP/2.
- 8.5.2 As part of the gas supply, there may be the requirement for a booster which introduces additional requirements. The installation of the booster shall be in accordance with IGE/UP/2.
- 8.5.3 Where the installation includes a booster on the gas supply, the increased possibility of a significant gas escape or a catastrophic failure shall be taken into account in the risk assessment and in the design of the installation and the plant room.

8.6 COMBUSTION EQUIPMENT

8.6.1 The combustion equipment shall conform to the appropriate standards for gas fired boilers or for gas fuelled engines.

8.6.2 When selecting equipment for energy centres the minimum operating pressure of the boilers or CHP engines shall be considered.

Note: Boilers and engines need to operate safely at 14 mbar (P_{ign}) and, safely and efficiently at 17 mbar (P_{min}).

Where these pressures are not suitable for the appliance, other methods of increasing the pressure may need to be considered for example, installing a booster in accordance with IGEM/UP/2 or obtaining higher pressure from the GT via a gas supply ancillary pressure agreement.

8.6.3 Account shall be taken of the required maximum gas flow rate and an allowance should be made for any possible increase in the load.

Note 1: Where the development is of a known size additional load increases for energy centres are not normally required.

Note 2: The maximum gas flow rate may be less than the total connected load. For example if, standby boilers are specified in the design and are not intended to be operated at the same time as other gas equipment. In this instance there will need to be appropriate systems in place to ensure that appliances cannot operate at the same time, which could lead to an unsafe situation developing.

This can be achieved in a number of ways ranging from having the standby appliances physically disconnected from the gas supply to having a sophisticated building management system (BMS) controlling the ignition sequences.

With regard to commissioning the system, the responsible person will need to ensure that each appliance can be operated safely when individually connected to the gas supply and that the BMS manages the rotation between 'in use' and 'standby' modes of operation automatically. The latter is particularly relevant when the sum of the appliance consumption rates exceeds the design flow rates of the meter and gas installation pipework. Further guidance is contained in IGEM/UP/4 and IGE/UP/10.

SECTION 9 : INSTALLATION PIPEWORK, GAS APPLIANCES AND CHIMNEYS

9.1 INSTALLATION PIPEWORK

9.1.1 Installation pipework shall be designed and installed in accordance with BS 6891 or IGEM/UP/2, as appropriate, and must be installed and maintained in accordance with GS(I&U)R.

9.1.2 The maximum diameter of installation pipework within an individual domestic dwelling shall not exceed 35 mm (1¹/₄ in).

The maximum pressure drop from the outlet of the gas meter installation to any appliance inlet connection shall not exceed 1 mbar under maximum flow conditions.

9.1.3 Where the meter installation is remote from the dwelling, the designer and/or the installer of the installation pipework shall determine the pipe diameter and installation volume.

Where the pipe diameter exceeds 35 mm, the installation shall be designed and installed in accordance with IGEM/UP/2 and a notice should be placed near or adjacent to the meter outlet point indicating that the pipework diameter exceeds 35 mm.

Where the installation volume exceeds 0.035 m³, the installation shall be tested and commissioned in accordance with either IGE/UP/1 or IGE/UP/1A; and a notice shall be placed near or adjacent to the meter outlet point indicating that the installation volume exceeds 0.035 m³.

9.1.4 Particular attention is drawn to the following:

- where the gas meter is remote from the dwelling, an AECV labelled in accordance with GS(I&U)R must be fitted as near as practicable to the point where the pipe enters the individual dwelling (see Sub-Section 7.7)
- where not available on a primary meter at a dwelling, for example where an AECV is fitted without a meter, a pressure test point shall be fitted within 300 mm downstream of the AECV (see BS 6891)
- pipe and fittings of steel, pliable corrugated tubing, malleable iron or copper may be used, but PE must not be used inside a building
- only screwed, welded, or end load and fire resistant iron/steel fittings shall be used for pipework installed in, or passing through, a protected shaft containing a stair and/or lift or other protected escape route, common areas, escape routes, or individual dwellings not supplied by the pipework

Note 1: The intention of this is to:

- restrict the use of non-steel pipes to individual consumers' pipework within their own dwelling
- maximise the fire safety and general integrity of gas pipework in common areas.

Note 2: Compression fittings are not allowed in protected shafts i.e. the pipe needs to be continuous.

Note 3: Access to screwed joints will be required for maintenance.

- where pipework passes through a dwelling other than the one it supplies, it shall be enclosed in a purpose-provided duct
- pipework passing through a wall or floor shall be sleeved and take the shortest practical route

Note: The coating on pliable corrugated tubing/copper does not fulfil such a purpose and a purpose designed sleeve has to be applied i.e. the sleeve needs to be corrosion resistant, impermeable to gas and protecting the enclosed pipe against failure by movement of the structure.

- any duct or other void such as a ceiling void containing installation pipework shall be ventilated in accordance with BS 8313

Note: Where a duct is continuous, ventilation can, normally, be achieved by providing openings at top and bottom, direct to outside air, in accordance with BS 8313. Where a duct takes the form of an enclosure at each storey level, ventilation in accordance with BS 8313 is, normally, required at each storey level.

Similarly as for pipelines, the provision of ventilation air via purpose-provided ducts is not a preferred arrangement. Where such an arrangement is made, the ventilation provided has to be sufficient as to achieve the required ventilation levels for the pipework itself.

- any protected shaft containing installation pipework should be ventilated at high and low level direct to outside air to the levels given in BS 8313
- pipework shall be fire-stopped as it passes from one fire compartment to another unless it is in its own ventilated protected shaft which is ventilated top and bottom directly to outside air. When pipework from a continuous duct enters a dwelling, it shall be fire-stopped at the point of entry
- pipework shall not be installed in a ventilation or air-conditioning duct and shall be physically spaced from other services such as water, electricity, telecommunication and drainage
- pipework shall be supported adequately along its length (see Table 9)
- for a meter not located within a dwelling, pipework shall be marked clearly (adjacent to the meter) to indicate the dwelling it supplies
- pipework shall be routed such as to avoid the risk of mechanical damage.

NOMINAL BORE (mm)	MAXIMUM UNSUPPORTED LENGTH (m)					
	Screwed steel horizontal	Screwed steel vertical	Welded steel horizontal	Welded steel vertical	External PE	Copper/ corrugated stainless steel
15	2.0	2.5	2.5	3.1	See Note	1.2
20	2.5	3.1	2.5	3.1		1.8
25	2.5	3.1	3.0	3.7		1.8
32	2.7	3.3	3.0	3.7		2.5
40	3.0	3.7	3.5	4.3		2.5
50	3.0	3.7	4.0	5.0		2.5
65			4.5	5.6		2.5
80			5.5	6.8		2.5
100			6.0	7.5		
150			7.0	8.7		
200			8.5	10.6		
250			9.0	11.2		

Note: For proprietary systems (e.g. external PE riser systems), see the manufacturer's instructions.

TABLE 9 - SUPPORTING ABOVE-GROUND INSTALLATION PIPEWORK

9.2 SELECTION AND INSTALLATION OF GAS APPLIANCES

BS 5440 and IGEN/UP/17 provide additional requirement and detailed advice on shared flue systems, flue termination positions and air supply routes which may require particular attention in multi-occupancy buildings.

9.2.1 Selection

Any new appliance shall be CE marked and be suitable for use in the particular circumstances that apply in multi-occupancy buildings with regard to flueing and ventilation.

For all appliances, particular attention is drawn to the following:

- flueing and ventilation shall be in accordance with BS 5440. Where a shared flue system is to be employed, only appliances that are specified by the appliance manufacturer as being suitable shall be used
- any appliance intended for fitting in a room containing a bath or shower must be room sealed
- any gas fire, space heater, central heating boiler or water heater of net heat input exceeding 12.7 kW, intended for fitting in a room used or intended to be used as sleeping accommodation, must be room sealed
- any gas fire, space heater or water heater of net heat input not exceeding 12.7 kW net, intended for fitting in a room used, or intended to be used, as sleeping accommodation, must be room sealed or incorporate a safety control device which will shut down the appliance before there is a build-up of a dangerous amount of products of combustion in the room concerned
- where a gas cooker is to be installed into an internal kitchen, ventilation must be provided in accordance with appropriate Building Regulations and shall be in accordance with BS 5440-2
- any flueless appliance shall have a flame supervision device (FSD) fitted to each burner (except for cooker oven burners of uncontrolled heat input less than 0.6 kW)

Note 1: A FSD is a device, including a sensing element, which causes the gas supply to a burner to be opened or closed according to the presence or absence of the flame which activates the sensing element.

Note 2: A device that only attempts automatically to re-light gas does not satisfy this clause.

- where the appliance is to be installed in a timber framed building, the appliance manufacturer's instructions have to advise that the appliance is suitable for installing in such a building.

9.2.2 Installation

Appliances shall be installed in accordance with the manufacturer's instructions and the relevant British Standards given Table 10.

APPLIANCE TYPE	REFERENCE
Fires, convector heaters, fire/back boilers and decorative fuel effect gas appliances	BS 5871-1, 2, 3 and 4
Water heaters	BS 5546
Central heating boilers	BS 6798
Ducted warm air heaters	BS 5864
Cookers	BS 6172
Catering appliances	BS 6173
Tumble dryers	BS 7624

TABLE 10 - APPLIANCE INSTALLATION STANDARDS

9.3 **MAINTENANCE OF GAS APPLIANCES**

9.3.1 Any person carrying out maintenance of a gas appliance must be competent to carry out the work.

9.3.2 Maintenance of any gas appliance shall be in accordance with the manufacturer's instructions.

9.3.3 As part of a maintenance schedule, checks must be made to ensure that:

- the operation of the chimney is satisfactory
- the entire chimney system and every joint can be inspected

Note: Where the chimney is located in a void, inspection hatches will be required.

- there is an adequate supply of combustion air
- the appliance operating pressure or heat input is correct
- the appliance is operating safely and efficiently
- any equipotential bonding arrangements are not adversely affected.

9.4 **LANDLORD'S GAS SAFETY CHECKS**

The landlord must ensure that:

- any gas installation is maintained in a safe condition
- each appliance and chimney is checked for safety within 12 months of the appliance being installed and at intervals of not more than 12 months since it was last checked for safety
- a record is made in respect of any appliance or chimney so checked and this record is retained for a period of two years from the date of that check
- a copy of the record of any check is given to the tenant or, where a tenant occupies the premises for a period of less than 28 days, a notice is displayed in a prominent position in the premises
- all gas work and safety checks are carried out by a class of persons as defined in GS(I&U)R
- installation pipework is in accordance with GS(I&U)R and an appropriate Standard (see BS 6891 or IGEM/UP/2 as appropriate).

Note: Further guidance is contained in HSL56, specifically the guidance to Regulation 36.

SECTION 10 : MATERIALS AND COMPONENT SPECIFICATIONS

10.1 Components shall be selected to an appropriate Standard. Examples are given in Table 11.

COMPONENT	STANDARDS
PE pipe and fittings Pipe Electrofusion fittings Mechanical transition fittings Butt fusion fittings PE valves (≤ 63 mm diameter)	GIS/PL2-1 - PE pipes and fittings, general GIS/PL2-2 - PE pipes and fittings, pipes GIS/PL2-4 - PE pipes and fittings, fusion fittings GIS/PL2-6 - PE pipes and fittings, spigot end fittings GIS/PL2-8 - PE pipes and fittings, pipes up to 7 bar GIS/PL3 - PE pipes and fittings, self-anchoring mechanical fittings GIS/V7-2 - PE Plastic bodied valves
Steel line pipe and fittings Threaded pipe and fittings	GIS/L2 - steel pipe (21.3 mm to 1219 mm) up to 7 bar GIS/F7 - steel welding pipe fittings IGE/TD/3, IGE/TD/4 - Distribution mains, Services BS EN 10255 ($\varnothing < 50$ mm), (medium/heavy grade)
Pliable corrugated tubing and fittings	BS 7838 - Partially replaced by BS 15266 BS EN 15266 - Stainless steel pliable corrugated tubing kits in buildings for gas with an operating pressure up to (≤ 0.5 bar)
Pliable stainless steel	BS EN ISO 10380 - Corrugated metal hoses and hose assemblies BS EN ISO 10806 - Fittings for corrugated metal hoses
Thermal cut-off devices (TCO)	DIN 3586 - Thermal cut-off devices <i>Note: It is possible to select TCOs that produce pressure drops of the order of 0.2 mbar or considerably less at the design flow.</i>
Excess flow valves (EFV)	DVGW VP 305-1 - Excess flow valves <i>Note 1: Valves need to be specified that operate between 15 and 100 mbar and with a closing flow factor of 1.3 - 1.45. These criteria are met by DVGW VP 305-1 Type K valves which are permitted by DVGW to be used in association with metallic installation pipework.</i> <i>Note 2: Additionally, valves need to be specified to suit the desired orientation (i.e. to suit horizontal, vertically upwards or vertically downwards gas flows). The manufacturer may combine some permitted orientations, e.g. a particular valve may work correctly for both horizontal and vertically upwards gas flows.</i> <i>Note 3: Where an EFV is fitted directly to the outlet of an ECV, the EFV installation may be more secure if an ECV with a BSP thread is used.</i>
Inlet Isolation valves (IIV)	BS EN 331 - Ball valves for gas installations in buildings BS 1552 - Taper plug valves PRS 1/E - Brass and copper fittings GIS/V7 - Distribution valves
Pipeline isolation valves (PIV)	GIS/V7 or V4, as appropriate
Steel fittings for welding	GIS/F7 - Steel welding pipe fittings
Emergency control valves (ECVs) Labelling ECVs Outlet connectors for ECVs	BS EN 331 - Ball valves for gas installations in buildings GIS/V7-3 - Brass valves and associated fittings up to 5 bar BS 1552 - Taper plug valves PRS1/E (≤ 50 mm (2 in) diameter) - Brass and copper fittings Union boss to BS 746, Comply with BS EN 331 or BS 1552
Meters	BS EN 1359 - Diaphragm gas meters BS EN 14236 - Domestic ultrasonic gas meters BS EN 12405 - Volume conversion devices BS EN 12480 - Rotary displacement gas meters
Meter housings	BS 8499 - Meter boxes and bracket IGEM/GM/6; IGE/GM/8 - Non-domestic meter installations
Domestic gas appliances	BS EN 30-1-1 - Domestic cooking appliances burning gas See Table 10
Electrical insulation joints	DIN 3389 - Insulating joints GIS/E17-2 - Specification for insulation joints. Joints operating at pressures not greater than 7 bar <i>Note: Following investigation into the suitability of GIS/E17-2:2006 for application in multi-occupancy applications further work is underway to revise its contents. In the meantime the only other Standard that appears to meet the requirements set out in Section 11 is DIN 3389-1 currently not available as an English translation.</i>

TABLE 11 - STANDARDS FOR MATERIALS AND SPECIFICATION OF COMPONENTS

SECTION 11 : ELECTRICAL SAFETY

11.1 GENERAL

- 11.1.1 A gas pipe shall not be used as an earth electrode or as a protective conductor.

Note: This is a requirement of BS 7671.

- 11.1.2 Where appropriate, an insulating fitting to prevent the flow of current along a gas pipe should be installed.

Note 1: Bonding and insulating requirements for various configurations of network and installation pipework are described in Appendix 5.

Note 2: This is a requirement of IGE/TD/4.

11.2 INSULATING FITTINGS

- 11.2.1 Insulating fittings shall be installed in all metal pipe, whether gas-carrying or containing a PE liner, capable of providing electrical continuity between earth and the above ground pipework.

Note 1: Earth in this context includes the ground and contiguous masonry such as the building wall or paving.

Note 2: An insulating fitting is not required where an alternative, reliable means of preventing electrical continuity between the metal pipe and earth has been provided, for example a sleeved, above ground entry connected to a PE network pipe.

- 11.2.2 Insulation fittings shall be installed in an accessible location as close to the pipe's entry into the building or, in the case of external pipework, as close as possible to the pipe's exit from the ground and upstream of any ECV. The uninsulated section of exposed pipe shall be as short as possible.

Note 1: Insulating fittings complying with DIN 3389-1 are suitable for use inside buildings. Fittings complying with GIS/E17-2:2006 are not suitable for use inside buildings.

Note 2: In all circumstances, particularly when the insulating fitting is installed outside a building, it has to be protected from the accumulation of debris and moisture which may compromise its insulating properties.

Note 3: Having regard to other features of the electrical and gas systems, the competent person may require additional insulation fittings to be installed within the gas network and installation piping.

- 11.2.3 All exposed pipe between the ground and the insulating fitting (including, where necessary, the metal body of the fitting itself) shall be encapsulated in an approved insulating sleeve or otherwise protected to prevent physical contact with the surface of the pipe. The wrapping or other protection shall be marked "Electric shock hazard, do not remove this sleeve/guard."

11.3 ELECTRICAL CONTINUITY BONDING

- 11.3.1 GS(I&U)R require that a temporary bond be used to maintain electrical continuity whenever a meter, gas pipe or fitting is disconnected.

- 11.3.2 Bonding connectors shall be to a design approved for that purpose comprising a suitable length of flexible insulated cable complete with clamps or other retaining devices at each end.

Note: The purpose of the bond is to maintain current flow to prevent a potential difference appearing across the gap in the pipework when the pipework is connected, disconnected or cut.

- 11.3.3 A temporary electrical continuity bond must be fitted before any part of a metallic network pipeline, meter installation or other pipework within properties is connected, disconnected or cut.
- 11.3.4 Bonding conductors must never bridge insulating fittings except during initial installation or when an insulating joint is being replaced.
- 11.3.5 Expansion joints and hoses fitted in internal pipework shall be permanently cross-bonded. Unless the design already provides electrical continuity then separate bonding shall be provided. Cross bonding shall be fitted before the joint or hose is removed.

Note: The typical design of joint already provides electrical continuity.

11.4 **CHECKING FOR ELECTRICAL FAULTS**

- 11.4.1 Prior to starting work, all exposed metal work in the work area shall be checked for the presence of excess AC voltage using an approved voltage detector. These checks shall include all electrically conductive parts such as metallic pipes, emergency controls, metallic sinks, domestic appliances etc.

Note: Stray currents may be present which may not be detected by a voltage detector. If in doubt a qualified electrician should be consulted.

- 11.4.2 In addition, the presence and condition of any bonding connections shall be visually inspected.

- 11.4.3 Work should cease until the installation has been checked and made safe by a qualified electrician, where:
- a voltage detector indicates the presence of stray voltage or
 - the bonding connection is missing or shows signs of damage or deterioration.

Note: For further information on electrical safety, see Appendix 5.

SECTION 12 : TESTING AND COMMISSIONING

12.1 GENERAL

- 12.1.1 Any person employed for testing or commissioning must be competent to carry out the work.
- 12.1.2 Testing and commissioning shall be carried out in accordance with the Standards listed in Table 12 and full records kept.

COMPONENT	STANDARDS
Network pipeline	IGE/TD/3 or IGE/TD/4, as appropriate (see Note)
Meter installation	IGE/UP/1 or IGE/UP/1A or IGEM/UP/1B or IGEM/UP/1C BS 6400 or IGEM/GM/6 or IGE/GM/8, as appropriate
Installation pipework	IGE/UP/1 or IGE/UP/1A or IGEM/UP/1B, as appropriate

Note: The pipe downstream of the PIV has to be tested at 350 mbar, without the ECV fitted, for 10 minutes, followed by a second test at 100 mbar with the ECV fitted in the open position and capped, for a further 10 minutes.

Where the ECV is designed to withstand a normal operating pressure in excess of 350 mbar, a GT may allow a combined test of 350 mbar for 10 minutes with the service off-take capped and the ECV in the open position. Before carrying this combined procedure, agreement of the test method will be required from the adopting GT.

TABLE 12 - TESTING AND COMMISSIONING STANDARDS

- 12.1.3 No gas should be allowed to flow to an ECV until the network installer is satisfied that the installed network pipeline (see Table 1) complies with this Standard and the approved design.

Note: Compliance with this Standard also requires satisfactory completion of ancillary features, for example ducting, ventilation, etc.

- 12.1.4 Commissioning of any gas appliance shall be in accordance with the manufacturer's instructions.

Safety checks must be made to ensure that:

- appropriate labelling is provided and, for multiple meter installations, the meter identification notice correctly shows the individual dwelling/unit served
- the operation of the chimney is satisfactory
- there is an adequate supply of combustion air
- the appliance operating pressure and heat input is correct
- the appliance is operating safely and efficiently
- any equipotential bonding arrangements are not adversely affected.

12.2 **EXISTING NETWORK PIPELINES**

12.2.1 The following re-commissioning criteria apply for existing pipeline systems:

(a) where all accessible pipework is observed to be in good condition and a risk assessment indicates that disturbance of joints could create a leak and the above ground network pipeline has been decommissioned either:

- due to the inadvertent operation of the PIV or IIV, or
- due to a leak on the pipeline upstream of the PIV, or
- where decommissioning was required to accommodate other works such as mains replacement activity

a pneumatic tightness test shall be applied and shall be carried out at operating pressure or higher before re-commissioning.

(b) where the reason for decommissioning was for any of the reasons given in (a) above and where:

- any section of the accessible pipeline is observed to be in poor condition, or
- a visual examination of large lengths of the above ground system is not possible

a successful combined strength and tightness test in accordance with the GT's procedures shall be applied before re-commissioning.

For both situations, prior to re-commissioning, consideration shall be given to applying other protective measures, such as "fill and drain" internal joint sealing techniques.

SECTION 13 : RECORDS, INSPECTION, MAINTENANCE AND MONITORING OF NETWORK PIPELINES

13.1 Any person carrying out inspection, maintenance or monitoring of network pipelines must be competent to carry out that work.

13.2 Installers and GTs shall ensure that adequate records of network pipelines in multi-occupancy buildings are made and maintained. Where practicable this should contain the following information:

- building address
- MPRNs
- access details for maintenance and inspection
- plant location e.g. pipelines, meters, valves etc.
- building construction
- number of floors and the number of dwellings per floor
- construction details
- method of pipeline entry
- subsequent alterations.

The GT shall set out a reasonably practical procedure for gaining access to the building.

Note: This may involve identifying the owner/landlord of the building. This information can be obtained from a number of sources, for example, the original developer, the Land Registry or any other previous records.

Record details shall be adequate to enable the operator to carry out required inspection and maintenance.

The GT shall set out a reasonably practical procedure for recording the location of and accessibility of valves.

13.3 The GT shall consider both how and when above ground network pipelines will be surveyed and examined to validate and maintain it in a safe condition, in accordance with Regulation 13 of PSR.

Note: Further information can be found in HSL82, guidance notes 59 to 63.

13.4 A written procedure for the inspection, maintenance and monitoring of the network pipeline shall be drawn up. The procedure shall consider the following:

- inspection frequency

Note 1: Consideration may be given, where appropriate and feasible, to co-ordinating inspections with the Landlord's safety inspections.

Note 2: The frequency of periodic inspection of an installation will depend on the type of installation, its location, the numbers of persons affected, building use, the frequency and quality of maintenance, operational history, condition and the external influences to which it is subjected such as building movement, thermal cycling and the ambient environment.

- what kind of monitoring system will be employed

Note: Consideration may be given to undertaking a visual inspection, measuring the pipe wall thickness where there are signs of corrosion and testing the atmosphere with a leakage detector.

- what parts of the installation and its environment will be inspected. This may include building layout, ventilation, valve arrangements, building type/use, materials, pipe diameters, joint type etc.
- how the inspection will be carried out
- what is to be recorded
- maintenance history
- formulation and implementation of a maintenance action plan following inspection and analysis of the results of that inspection
- determination of the appropriate Standards and procedures that will be applied.

Note: A risk based rationale may be applied where access to all flats is not reasonably practicable.

APPENDIX 1 : GLOSSARY, ACRONYMS, ABBREVIATIONS, UNITS, SYMBOLS AND SUBSCRIPTS

GLOSSARY

lateral Horizontal pipe, connected to a riser, that conveys gas along one floor level within a building.

Note: For the purposes of this standard, a lateral is a network pipeline, typically horizontal, serving one dwelling and connected to a riser.

riser Vertical pipe that carries gas between floors within a building.

Note: For the purposes of this standard, a riser is a network pipeline, typically vertical, serving one or more dwellings.

All other definitions are given in IGEN/G/4 which is freely available by downloading a printable version from IGEN's website www.igem.org.uk.

Standard and legacy gas metering arrangements are given in IGEN/G/1 which is freely available by downloading a printable version from IGEN's website.

ACRONYMS AND ABBREVIATIONS









ACoP	Approved Code of Practice
AC	alternating current
ACS	Accredited Certification Scheme
AD	approved document
AECV	additional emergency control valve
BIV	branch isolation valve
BMS	building management system
CDM	Construction (Design and Management) Regulations
CHSWR	Construction (Health, Safety and Welfare) Regulations
CNE	combined neutral and earth
CO	carbon monoxide
CP	cathodic protection
CSA	cross sectional area
DMIV	distribution main isolation valve
DMP	design minimum pressure
DPC	damp proof course
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations
ECV	emergency control valve
EFV	excess flow valve
ENA	Energy Networks Association
ESP	emergency service provider (gas)
EUSC	Energy and Utility Skills Council
FSD	flame supervision device
GB	Great Britain
GS(I&U)R	Gas Safety (Installation and Use) Regulations
GS(M)R	Gas Safety (Management) Regulations
GT	gas transporter
HSWA	Health and Safety at Work etc. Act
HSE	Health and Safety Executive
IET	Institution of Engineering and Technology
IGEM	Institution of Gas Engineers and Managers
IIV	inlet isolation valve
IV	isolation valve
LIV	lateral isolation valve
LOP	lowest operating pressure
MAM	meter asset manager
MHSWR	Management of Health and Safety at Work Regulations
MOP	maximum operating pressure
MPRN	meter Point Reference number

NG	Natural Gas
NVQ	national vocational qualification
OP	operating pressure
PE	polyethylene
PIV	pipeline isolation valve
PME	protective multiple earthing
PRI	pressure regulating installation
PSR	Pipeline Safety Regulations
PSSR	Pressure Systems Safety Regulations
PVC	polyvinylchloride
SIV	service isolation valve
SNE	separate neutral earth
SVP	soil and vent pipe
TCO	thermal cut off device
TWI	The Welding Institute
UK	United Kingdom.

UNITS

A	ampere
in	inch
kW	kilowatt
m	metre
mbar	millibar
mm	millimetre
mm ²	square millimetre
m ²	square metre
m ³	cubic metre
m ³ h ⁻¹	cubic metre per hour
°C	degrees Celsius.

SYMBOLS

	valve
	regulator
	primary/secondary meter
	appliance
	building/individual dwelling within the building (as appropriate)
	network
	meter installation
	installation pipework
<	less than
≤	less than or equal to
>	greater than
Ø	diameter
H	altitude change
h	pressure change due to altitude
P	pressure
Q	flow rate
s	density of gas relative to air.

SUBSCRIPTS

ign	ignition
max	maximum
mi	meter installation
min	minimum.

APPENDIX 2 : REFERENCES

A2.1 LEGISLATION

This sub-appendix lists legislation referred to in these Standards as well as legislation not referenced but which may be applicable.

- Control of Pollution Act 1974, as amended
- Environment Act 1995
- Environmental Protection Act 1990
- Gas Act 1986 as amended by the Gas Act 1995 and incorporating stand-alone provisions of the Utilities Act 2000
- Health and Safety at Work etc. Act 1974
- New Roads and Street Works Act 1991
- Pipelines Act 1962
- Town and Country Planning Act 1990
- Water Resources Acts 1963 and 1991
- Utilities Act 2000
- Building Regulations (England and Wales) 2000
- Building (Scotland) Regulations 2004
- Control of Substances Hazardous to Health Regulations 2002
- Construction (Design and Management) Regulations 2007
- Dangerous Substances and Explosive Atmospheres Regulations 2000
- Electrical Safety, Quality and Continuity Regulations
- Electricity at Work Regulations 1989
- Gas Appliances (Safety) Regulations
- Gas Meters (Information on Connection and Disconnection) Regulations 1996
- Gas Safety (Installation and Use) Regulations 1998
- Gas Safety (Management) Regulations 1996
- Gas Safety (Rights of Entry) Regulations 1996
- Housing Act 2004
- Lifting Operations and Lifting Equipment Regulations 1998
- Management of Health and Safety at Work Regulations 1999
- Manual Handling Operations Regulations 1992
- Noise at Work Regulations 1989
- Personal Protective Equipment at Work Regulations 1992
- Pipelines Safety Regulations 1996
- Pressure Equipment Regulations 1999
- Pressure Systems Safety Regulations 2000
- Provision and Use of Work Equipment Regulations 1998
- Regulatory Reform (Fire Safety) Order 2005
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995
- Rights of Entry (Gas and Electricity Boards) Act 1954
- Work at Height Regulations 2005
- Workplace (Health, Safety and Welfare) Regulations 1992, as amended by the Health and Safety (Miscellaneous Amendments) Regulations 2002.

A2.2

HSE ACoPs AND GUIDANCE

- HSC CoP 20 "Standards of training in safe gas installation"
- HSG48 Human factors in industrial safety. Guidance
- HSL56 Safety in the installation and use of gas systems and appliances. Gas Safety (Installation and Use) Regulations. ACoP and Guidance
- HSL81 Design, construction and installation of gas service pipes. ACoP and Guidance
- HSL82 Pipelines Safety Regulations. Guidance
- HSL122 Safety of pressure systems. Pressure Systems Safety Regulations 2000. ACoP
- HSL134 Design of plant, equipment and workplaces; Dangerous Substances and Explosive Atmospheres Regulations 2002. ACoP and Guidance
- HSL135 Storage of dangerous substances; Dangerous Substances and Explosive Atmospheres Regulations 2002. ACoP and Guidance
- HSL136 Control and mitigation methods; Dangerous Substances and Explosive Atmospheres Regulations 2002. ACoP and Guidance
- HSL137 Safe maintenance, repair and cleaning procedures; Dangerous Substances and Explosive Atmospheres Regulations 2002. ACoP and Guidance
- HSL138 Dangerous Substances and Explosive Atmospheres Regulations 2002. ACoP and Guidance
- HSL144 Managing Health and Safety in Construction. Construction (Design and Management) Regulations 2007. ACoP and Guidance
- HSR25 Memorandum of Guidance on the Electricity at Work Regulations
- INDG370 Fire and explosion; How safe is your workplace? A short guide to the Dangerous Substances and Explosive Atmospheres Regulations 2002
- R2P2 Reducing risks, protecting people. HSE's decision making process.

A2.3

IGEM STANDARDS

- IGE/TD/3
Edition 4 Steel and PE pipelines for gas distribution
- IGE/TD/4
Edition 4 PE and steel gas services and service pipework
- IGE/TD/13
Edition 2 Pressure regulating installations for Natural Gas, Liquefied Petroleum Gas and Liquefied Petroleum Gas Air
- IGE/GM/6
Edition 2 Non-domestic meter installations. Standard designs
- IGE/GM/7A Electrical connections for gas metering equipment
- IGE/GM/7B Hazardous area classification for gas metering equipment
- IGE/GM/8
Parts 1 to 5 Non-domestic meter installations. Flow rate exceeding $6 \text{ m}^3 \text{ h}^{-1}$ and inlet pressure not exceeding 38 bar

- IGE/SR/24 Risk assessment techniques
- IGE/SR/25 Hazardous area classification of Natural Gas
Edition 2 installations
- IGE/UP/1 Strength and tightness testing and direct purging of
Edition 2 industrial and commercial gas installations
Reprint with Amendments
- IGE/UP/1A Strength and tightness testing and direct purging of
Edition 2 small low pressure industrial and commercial
Reprint with Amendments Natural Gas installations
- IGE/UP/1B Tightness testing and direct purging of small
Edition 3 Liquefied Petroleum Gas/Air, Natural Gas and Liquefied
Petroleum Gas installations
- IGE/UP/1C Strength testing, tightness testing and direct
purging of meter installations of maximum
operating pressure not exceeding 7 bar
- IGE/UP/2 Installation pipework on industrial and commercial
Edition 2 premises
- IGE/UP/7 Gas installations in timber framed and light steel
Edition 2 framed buildings
- IGE/UP/16 Design for Natural Gas installations on industrial and
commercial premises with respect to hazardous area
classification and preparation of risk assessments
- IGE/UP/17 Shared chimney and flue systems for domestic gas
appliances
- IGE/GL/1 Planning of gas distribution systems operating at
Edition 2 pressures not exceeding 16 bar
- IGE/G/1 Defining the end of the Network, a meter
installation and installation pipework.

A2.4

BRITISH STANDARDS (abbreviated titles)

- BS 21 Pipe threads for tubes and fittings
- BS 476 Fire tests on building materials and structures
- BS 746 Gas meter unions and adaptors
- BS 951 Electrical earthing clamps
- BS 1552 Taper plug valves
- BS 1560-3.2 Circular flanges for pipes, valves and fittings
- BS 1640-3 Steel butt welding pipe fittings
- BS 2971 Arc welding of carbon steel pipework
- BS 3799 Steel pipe fittings, screwed and socket-welding
- BS 4872 Approval testing of welders
- BS 5440-1 Flues and ventilation
- BS 5440-2 Ventilation
- BS 5546 Installation of hot water supplies
- BS 5864 Installation of gas fired ducted air heaters
- BS 5871 Installation of gas fires, convector heaters, etc.
- BS 5925 Ventilation principles and designing for natural
ventilation
- BS 6001 Procedure for inspection by attributes

- BS 6172 Installation of domestic gas cookers
- BS 6173 Installation of catering appliances
- BS 6400-1 Domestic-sized gas meters – low pressure
- BS 6400-2 Domestic-sized gas meters – medium pressure
- BS 6501 Metallic hose assemblies
- BS 6798 Installation of gas fired boilers
- BS 6891 Low pressure gas pipework in domestic premises
- BS 6956 Jointing materials and compounds
- BS 7281 PE pipes
- BS 7624 Installation of tumble dryers
- BS 7671 IET Wiring Regulations

Note: The 17th Edition was published in 2008. An amendment to this Edition was issued in 2011 and came into force on 1st January 2012.

- BS 7838 Corrugated stainless steel semi rigid pipe
- BS 8313 Services in ducts
- BS 8499 Domestic gas meter boxes and meter brackets
- BS EN 30-1-1 Domestic gas cooking appliances
- BS EN 287-1 Testing of welders. Fusion welding
- BS EN 331 Ball valves
- BS EN 751 Sealing materials
- BS EN 1359 Diaphragm gas meters
- BS EN 1092-1 Flanges and their joints
- BS EN 1337 Structural bearings
- BS EN 1995-1 Design of timber structures
- BS EN 10253-1 Butt-welding pipe fittings
- BS EN 10255 Non-alloy steel tubes suitable for welding and threading
- BS EN 12405 Gas meters – volume conversion devices
- BS EN 12436 Ultrasonic domestic gas meters
- BS EN 12480 Rotary displacement gas meters
- BS EN 12732 Gas supply systems - Welding steel pipework
- BS EN 15266 Stainless steel pliable corrugated tubing kits in buildings for gas
- BS EN 62305 Protection against lightning
- BS EN ISO 10380 Corrugated metal hose and hose assemblies
- BS EN ISO 10806 Fittings for corrugated metal hoses
- BS EN ISO 15614-1 Welding procedures. Arc welding.

A2.5

INTERNATIONAL STANDARDS (abbreviated titles)

- DIN 3586 Thermal cut-off devices
- DIN 3389-1 Insulating joints
- DVGW VP 305-1 Excess flow valves
- ISO 7-1 Pipe threads.

A2.6

GAS INDUSTRY STANDARDS

- GIS/L1 Seamless line pipe 40 mm to 100 mm inclusive nominal size for operating pressure greater than 7 bar

- GIS/F7 Steel welding pipe fittings 15 mm to 450 mm inclusive nominal size for operating pressures not greater than 7 bar
- GIS/L2 Steel pipe 15 mm to 450 mm inclusive nominal size for services at pressures up to 7 bar supplementary and amending specification to BS 3601
- GIS/PL2-1 Polyethylene pipes and fittings for natural gas and suitable manufactured gas pipes for use at pressures up to 5.5 bar
- GIS/PL2-3 Polyethylene pipes and fittings for natural gas and suitable manufactured gas butt fusion tooling and ancillary equipment
- GIS/PL2-4 Polyethylene pipes and fittings for natural gas and suitable manufactured gas fusion fittings with integral heating element(s)
- GIS/PL2-6 Polyethylene pipes and fittings for natural gas and suitable manufactured gas spigot end fittings for electrofusion and/or butt fusion purposes
- GIS/PL2-8 Polyethylene pipes and fittings for natural gas and suitable manufactured gas pipes for use at pressures up to 7 bar
- GIS/PL3 Self anchoring mechanical fittings for polyethylene pipe for natural gas and suitable manufactured gas
- GIS/V7-1 Technical specification for distribution valves Metal bodies line valves for use at pressures up to 16 bar and construction valves for use at pressures up to 7 bar
- GIS/V7-2 Technical specification for distribution valves Plastic bodied valves of sizes up to 63 mm suitable for operations at pressures not exceeding 5.5 bar
- GIS/V7-3 Specification for distribution valves. Part 3: Brass valves and associated fittings for pressures not exceeding 5 bar
- GIS/V4 Specification for Service isolation valves up to 50 mm diameter for use up to 7 bar maximum operating pressures.

A2.7 GL NOBLE DENTON (available through IGEN)

- PRS/1E Issue 3 Brass and copper fittings
- PRS/3E Meter regulators (Low pressure).

A2.8 OFGEM

- MAMCoP Meter Asset Manager's Code of Practice.

A2.9 RESEARCH REPORTS

- ERS R3845 Riser and lateral finite element analysis
- ERS R4088 Design guidelines for internal steel riser laterals
- RR630 Area classification for secondary releases from low pressure natural gas systems.

A2.10 MISCELLANEOUS (abbreviated titles)

- Gas Industry Unsafe Situations Procedures, 6th Edition (Gas Safe Register)
- The investigation and control of gas explosions in buildings and heating plant (Harris, R.J., 1983).

APPENDIX 3 : RISK ASSESSMENT

All standards aim to ensure the safety of all persons and buildings. However, certain types of property (related to public access and/or the local environment) are at a higher risk of interference with the gas supply; multi-occupancy buildings concentrate large numbers of residents who can be affected; and, depending on the type of construction, an incident can cause significant damage beyond the source. Catastrophic failure of the gas supply to or within a multi-occupancy building is, defined as a more serious failure than would normally be expected during the life of the installation, from whatever cause, is perceived to be a greater risk than for traditional housing. It is clearly the case that the gas supply in a multi-occupancy building is a greater societal risk, and it is societal risk which is more of a driver for gas safety since the individual risk from the gas supply is at a level which would be considered acceptable.

This standard provides additional requirements for multi-occupancy buildings such as, components used in the installation and the siting of gas supplies. However, it is not possible to cover the whole range of situations to be addressed in a specific way. Therefore, it is important that the designer of the installation be able to demonstrate that the hazard arising from the installation and the risk of a gas release leading to a fire or explosion with unacceptable consequences are adequately controlled. This will require a risk assessment to be carried out, either for a generic design or for the individual installation. The requirement is set out in Section 4. This Appendix provides guidance for those specific issues related with multi-occupancy buildings to assist in meeting this requirement. Further general guidance can be found in IGE/SR/24.

A3.1 RISK ASSESSMENT PROCEDURE

A3.1.1 Hazard identification

The hazard to be addressed is a release of containment from the gas supply as a result of the failure of a pipe or fitting or joint leading to an uncontrolled gas release which, on ignition, results in a fire or, more seriously, of the release of gas into a confined space within a building space or compartment in a quantity capable of forming a flammable mixture which on ignition leads to an explosion resulting in damaging overpressures. The factors which contribute to this are:

- the likelihood of a release from pipework or component failure. This is a function of the diameter and wall thickness of the pipework, the integrity with respect to corrosion and fatigue, and the location with respect to the possibility of accidental damage or of interference
- the credible failure modes from the failure causes, whether a minor leak or a break
- the gas release rate on failure, which is a function of the failure size, the upstream supply system and the supply pressure
- the ventilation in any enclosure where a release could occur. The ventilation flow acts to dilute and disperse any gas released
- the degree of confinement (ability to vent an explosion overpressure) of any compound/enclosure where gas could be released or could accumulate. This is a function of the failure pressure of elements of the compound/enclosure, such as windows, doors or lightweight panels which could act as vents, their weight per unit area, and their area as a proportion of the dimensions of the compound/enclosure
- the contribution to the integrity of the building of any compound/enclosure in which an explosion could occur and result in damage to structural elements.

Further guidance on confined spaces, particularly below ground spaces, is given in Section A3.2 below.

A3.1.2 **Hazard reduction**

Following the identification of the hazards and the means by which these may be realised it is important as a next step to consider ways of reducing or eliminating (designing out) hazards before considering means to assess or mitigate the likelihood of their occurrence (the risk). Means of hazard reduction would include:

- locating pipework out of doors
- keeping pipework out of strongly confined spaces, for example avoiding below ground entries
- minimising pipe lengths
- restricting the extent of the installation.

A3.1.3 **Risk evaluation**

A3.1.3.1 *Failure mode*

The possible failure modes of the system will be determined by the effect of the causes of failure which can be identified for the system, and the properties of the materials employed i.e. whether there is leak before break behaviour or where an immediate complete break (catastrophic failure) is possible.

A3.1.3.2 *Failure frequency*

Failure frequency data relevant to the installation ought to be used however it is recognised that these may be difficult to obtain. It may not be possible to go further than rank, in a qualitative but supportable way, the likelihood of failure of the different pipe lengths and components.

A3.1.3.3 *Failure consequences*

The consequences of releases into confined compound/enclosures: the build up of a flammable mixture; the propagation of a flame through the mixture; and the generation of an explosion overpressure, can be complex but are able to be estimated with reasonable confidence. Studies have been carried out over a number of years by GL Noble Denton and its predecessors, HSE, and the Building Research Establishment; see for example: Appendix 2.10, 'The investigation and control of gas explosions in buildings and heating plant'.

A3.1.4 **Mitigation**

After the proposed design and location of the pipework installation has taken into account the risk of a gas release, mitigation measures can be taken at this stage to reduce the risk further, applied both to the likelihood of failure and the consequences. Measures which can be adopted include: increased pipe wall thickness, welded joints instead of screwed joints, excess flow valves, and increased ventilation.

A3.1.5 **Significance of risk**

At each stage of the above process it may be demonstrated that the design results in an unacceptable result and the design needs to be revisited. In addition the risk assessment process is iterative and for each mitigation measure considered the reduction in either the frequency or consequences is evaluated until the final design of the supply can be demonstrated to comply with the 'So Far As Is Reasonably Practicable' requirement of UK Health and Safety legislation, usually referred to as 'As Low as Reasonably Practicable' or ALARP. For further guidance see R2P2.

A3.2 **SPECIFIC AREAS REQUIRING CONSIDERATION**

A3.2.1 **Confined spaces**

A3.2.1.1 *Introduction*

The sections in the Standard on service entries and service risers intentionally favour the installation of external risers as being the more inherently safe option. Where risers are to be internal it is recommended that the service entry be above ground. The option remains however for service entries to be below ground or through below ground spaces such as car parks or basements. This section gives additional guidance on confined spaces in general; this is most relevant to below ground spaces because of their location with respect to the main structural elements of the building. For below ground entries a specific risk assessment will be required for such installations.

The position of the service entry may in turn determine the location of the meter installation.

A3.2.1.2 *Hazard*

The most significant hazard is, as described in Appendix 3.1.1 above, that of a gas release into a confined space leading to the formation of a flammable mixture which on ignition could lead to an explosion. The specific features which can increase the hazard are related to the following:

- **the failure causes**

The access to, and security of, the installation influence the possibility of the occurrence of accidental or deliberate damage.

The environment in below ground spaces may influence the likelihood of corrosion.

- **the gas release rate**

The below ground level installation will include the inlet supply hence will include the largest pipe sizes and highest pressures involved.

- **the formation of a flammable mixture**

The formation of a flammable mixture is a function of the gas release rate, the volume of the compound/enclosure, and the ventilation air rate. Ventilation of below ground spaces is very variable, that of basements and service spaces may be limited whereas a car park, depending on its design, may be very well ventilated. Note that ventilation provided for below ground spaces may not be guaranteed if there are problems of vandalism or rubbish.

- **the pressure generated**

The pressure generated in an explosion is related to the ability to vent any pressure rise. Many below ground spaces will not incorporate elements which can fail at a low pressure and vent any pressure rise outside the structure. The pressure rise is therefore likely to be higher than for above ground sections of the building, hence potentially leading to damage to structurally stronger elements, and with venting being more likely to be upwards into the above ground section of the building. As with ventilation the effects will be most serious for confined basements and service spaces and least with more open areas such as car parks.

- **the resultant damage**

The response of the structure to the overpressure generated depends on the design of the structure and the contribution to the structural strength of those parts likely to fail. The elements which will experience most damage are likely to be those having the largest areas such as walls and ceilings. The

effect on the structure will, therefore, depend on whether these elements provide the integrity of the structure or whether this is provided by, for example, a steel or reinforced concrete frame.

As confinement increases, the increased pressure generated will result in a greater degree of damage to the structure and to damage to more structurally significant elements. Failure of higher strength components of the structure may then lead to further structural failure.

A3.2.1.3 *Mitigating measures*

The risk to persons and property from the hazard of an explosion in a confined space can be mitigated by a number of measures, the most obvious being to remove or reduce the hazard by excluding gas supplies from such spaces, particularly those below ground.

- **likelihood of failure**

Consideration needs to be given to the mechanical integrity of pipes and fittings, for example by increasing the wall thickness of pipes and using all welded construction. Potential sources of release such as the meter installation will require special consideration (see A3.3.2 below).

In addition to the mechanical strength and the integrity of the installation, the influence of human factors, problems arising from maintenance or interference also have to be considered.

- **consequences of failure**

- *Release rate*: The release rate on failure is a function of the upstream supply and can be restricted by the fitting of an appropriately sited calibrated EFV in the gas supply to an individual dwelling (see section 3.5 below).
- *Formation of flammable mixture*: The most important means of addressing this is with ventilation, normally wind driven natural ventilation. A below ground car park, with openings on all sides, may have sufficient ventilation to prevent the formation of a flammable mixture from a complete break in the supply, however other spaces may have limited ventilation which may become blocked over time.

Options for preventing or mitigating the formation of a flammable mixture through a below ground space include isolating (or separating) the pipework installation and providing a dedicated direct access for ventilation to the outside, for example a duct. Other means such as mechanical ventilation, or gas detection and isolation, could be used, however these are not normally practical options in domestic situations.

- *Ignition*: Ignition sources can be minimised but cannot normally be controlled in domestic buildings.
- *Generation of overpressure*: The behaviour of a gas-air mixture on ignition is complex. It is a function of the mixture concentration, the volume of the compound/enclosure, the generation of turbulence, and the presence and location of weaker elements of the structure which will fail and initiate venting of the overpressure.

For above ground rooms and communal spaces, weaker elements such as doors and windows can act as vents and fail, thus reducing the overpressure generated. However, where a flammable mixture can form in more than one room or in a room not directly ventilated to outside, the effects of such vents is reduced.

For below ground spaces the presence of weaker elements such as doors, windows or lightweight panels is less likely and any access doors or ventilators are unlikely to be of adequate size to have any significant effect. Venting may be present (the case of car park spaces has already been referred to) or it may be possible to ensure the presence of vents

such as ventilation openings. Separation or isolation of the installation, such as with a duct as previously noted for mixture build up, will also mitigate this by preventing the mixture being present. The access to the outside from this has to however be such as to be able to vent any overpressure in this (probably much smaller) isolated volume to the outside without venting into the below ground space.

In summary gas supplies in below ground spaces need to be avoided where there is a practicable alternative. Where installations are to be sited below ground it can be seen that "openness" in terms of ventilation and venting is a key element in mitigation of the risk. A suggested alternative is the isolation (or separation) of the installation from the below ground space.

It is likely that gas supplies in well ventilated car park spaces will be acceptable, having due regard to the hazards inherent in such situations, whereas supplies will be unacceptable in strongly confined spaces where there is no provision to protect the integrity of the structure from the overpressure generated in an explosion.

A3.3 **CHECKLIST OF FACTORS TO BE CONSIDERED AND DESIGN OPTIONS**

A3.3.1 **Network Pipelines**

A3.3.1.1 *Factors*

- access for maintenance/inspection of condition
- the required location of meters i.e. external or internal
- risk of vandalism
- whether buildings in which pipe is installed are occupied
- degree of simplicity of ventilation
- the location of means of escape
- whether areas into which a pipeline enters are "confined"
 - length of buried pipe
 - pipe material and jointing method
 - potential for corrosion.

A3.3.1.2 *Options*

- external rather than internal risers
- internal risers near the outside rather than deep within buildings/building complexes (so decreasing the length of buried pipe and generally improving ease of access)
- simple ventilation methods rather than ducted air, and using ventilation directly, rather than indirectly, to outside air.

A3.3.2 **Meter Installation**

A3.3.2.1 *Factors*

- accessibility of the meter/housing, for example is it accessible to all building occupants or just one dwelling's occupants?
- any history of unauthorised interference in that geographical area
- any obvious concentration of criminal activity (including theft, vandalism and incompetent/unauthorised working) in that neighbourhood
- are the occupants of the building generally at higher risk in the event of an incident, for example are they generally older or infirm?
- does the location give concerns for the impairment of the means of escape in the event of an incident resulting in fire, explosion or structural damage?
- risk of flooding e.g. meter regulators, basement meter rooms.

A3.3.2.2 *Options*

- relocation to outside the building
- relocation to a more appropriate place within the building
- additional security, making access more difficult
- fitting of TCOs
- inclusion of calibrated EFVs
- locate meter installation above anticipated flood level.

A3.3.3 **Installation Pipework**

A3.3.3.1 *Factors*

- access for maintenance/inspection
- risk of vandalism
- access to the ECV(s) and additional emergency control valves (AECVs)
- the location of means of escape
- length of pipework to which access is difficult
- the number of AECVs
- pipe material and jointing method
- degree of simplicity of ventilation
- potential for corrosion
- potential load.

A3.3.3.2 *Options*

- using external rather than internal installation pipework risers
- additional security, making access more difficult
- using steel rather than copper/pliable corrugated tubing pipework
- simplifying ventilation methods.

A3.3.4 **Appliances**

A3.3.4.1 *Factors*

- type and age of chimneys, including shared chimneys and flues
- type and age of appliances
- safety devices fitted in rooms, on appliances and for chimneys
- vulnerability of the occupants, for example in relation to age, physical capability, etc.

A3.4 **EXCESS FLOW VALVES**

A3.4.1 **Introduction**

Sub-Section 4.2 requires that specific consideration be given in the risk assessment to the meter installation and the risk of a gas release into an individual dwelling. One particular need is that of determining the requirement for the fitting of an EFV. Since these devices have not historically been fitted but are now becoming increasingly available and specified further guidance on their properties and application, with respect to the risk from the gas supply, is given here.

A3.3.2.3 includes the installation of calibrated EFVs as one of the options where the risk assessment shows that there is a 'significantly higher risk of theft or vandalism' (compared to a typical average installation). Other options are quoted, however for a meter installation which has been sited inside a multi-occupancy building or within an individual dwelling in a multi-occupancy building the fitting of an EFV is likely to be one of the options requiring

consideration. See Appendix 3.5 for a description of the operation and properties of EFVs in the context of this application.

A3.4.2 **Hazard**

The specific hazard addressed in this section is that of a failure of the gas supply at or downstream of the meter installation within a dwelling leading to a gas release into the dwelling. The cause of failure is most likely to be from interference, whether accidental or deliberate and including theft, vandalism, poor installation practice, but could also result from a fire not initially involving the gas supply.

A3.4.3 **Risk Assessment**

The most effective means of controlling risk is to remove either the cause(s) of failure and/or the consequences whereas EFVs simply mitigate the consequences. Where the possibility of failure of the gas supply is prevented or made non-credible by other protective means, or the meter is sited in a location where the consequences of a gas release are limited, as set out in clause 4.2.2 the fitting of an EFV would not be necessary. Normally it is not possible to prevent failure, or to limit the consequences, for an internal meter location.

The purpose of this Section is to give guidance on the relative risk of different installations with reference to the need to install EFVs.

- **failure frequency**

No data on the number of incidents of gas release, fire or explosion in blocks of flats have been available in the preparation of this Section. Data may be available within the industry or from emergency call out records which could assist with a quantitative risk assessment of EFVs.

While the overall risk of explosion is low incidents have occurred and the general factors which contribute to the risk are known. In the first instance the assessment will probably have to be qualitative and based on the relative contribution of factors to the likelihood and the consequences of an incident. If gas release or incident data become available a more quantitative assessment would be possible.

Assuming an initially correctly installed gas supply system, failure would be predicted to result from deliberate or accidental damage. Failure is therefore more likely:

- where there is ready or public access to the meter installation
- where vandalism of the installation is credible
- where installation pipework and/or appliances can be removed as a result of theft
- where appliances and, possibly, pipework may be removed by occupants e.g. on moving premises
- where DIY on the gas installation is likely.

- **consequences of release**

The consequences of concern are those of a gas aided fire, or of an explosion, which can cause structural damage leading either directly to personal injury or indirectly due to the blocking of escape routes. The consequences of releases have been discussed in the preceding sections of this Appendix; they will be greater, on ignition, if a gas release is into a relatively strongly confined space, a poorly vented space, or a space with no direct access (vent) to outside i.e. an 'enclosed' room.

From a consideration of the likelihood and consequences of failure, as discussed above, it is possible to identify examples of installations which can be considered as being of 'lower risk' and of 'higher risk'.

A3.4.4 General guidance

- **Locations at 'lower risk'**
 - Where a release from a meter installation cannot enter a confined 'inhabited' space e.g. from an external meter box or a remote meter room i.e. the structure of the flats is not at risk from a gas escape.
 - Low rise properties of similar construction to normal housing where the hazard and risk would be the same as for normal housing.
 - Installations with external risers with the gas installation confined to rooms with an outside wall and window(s). The installation inside the property is limited and is in a location where the effects of an incident would be limited.
- **Locations at 'greater risk'**
 - Where a meter installation is accessible and a release can enter a confined inhabited space, e.g. internal meter, meter in common entrance area.
 - Installations with internal risers with the gas installation on the 'inside' of the property, e.g. internal kitchens. A release could be into a confined space with limited natural ventilation and venting only into another room.
 - Properties where an explosion can affect several dwellings, or the escape route(s). This will depend on the method of construction of the property.
- **Additional factors**

Regardless of the above, EFVs would likely be specified in blocks of greater than around 5 storeys (18 m - taken to be the limit of rescue from outside the building), where the need to protect escape routes is greater; and in blocks where the occupants are more likely to result in damage/interference with the installation e.g. transient populations, students, problem tenants.

A3.5 PROPERTIES OF AN EFV

A3.5.1 Introduction

An excess flow valve provides a safeguard against downstream escape exceeding a pre determined rate, typically a sensible margin above either the maximum demand or the rating of the installed meter; e.g. for a typical $6\text{ m}^3\text{ h}^{-1}$ domestic meter, the use of an EFV that trips in the range 7.8 to $8.7\text{ m}^3\text{ h}^{-1}$ would be expected (a lower value could be selected where the demand is (and will remain) significantly less than the meter capacity). This will protect the supply against catastrophic failure from causes such as:

- meter theft
- accidental damage
- vandalism
- the effects of fire.

Protection may also be provided against theft or damage to appliances and appliance connections. This is however dependent on the flow rate at the point of release which is a function of the installation. An open ended installation pipe would in many cases result in a release rate which exceeds the trip setting however it is self evident that leaks with a flow rate of less than the calibrated trip setting of the EFV will not be protected against.

While EFVs have a positive role, there are factors which may militate against their universal installation:

- the low risk of gas release and explosion would not suggest the need for universal additional safeguards
- there is a cost involved in their installation. This is not a large sum per installation but may represent a significant 'industry' investment
- their installation increases the pressure drop across the meter installation; this could be a problem where the available pressure drop is limited
- there is a potential ongoing maintenance requirement.

For the purposes of this application of EFVs, it is assumed that they are of the weep reset type, installed upstream of the meter.

A3.5.2 **Effectiveness**

A Failure Mode and Effect Analysis, on the general application of EFVs, has been carried out by the Health and Safety Laboratory (HSL) and reviewed specifically in the context of this application and for the type of EFV assumed. This has shown that:

- if a valve fails to operate on demand the situation is no worse than with no valve installed
- if a valve operates prematurely or due to surge the result is a nuisance isolation of the supply which will self reset if the downstream supply is isolated.

The review concluded that there are no identified failure modes which, for practical purposes, increase the risk from the installation.

There is a possible increase in the risk of unauthorised interference and of maloperation e.g. reset of a nuisance (rather than real) trip by using the ECV. This is an unlikely event and is unlikely to result in a serious hazard. It is covered by the requirement for flame failure devices on burners of unflued appliances.

There may be a problem with the pressure drop across the installation. This would not normally result in a hazard since appliances are required by standards to operate safely or to shut down on reducing supply pressure. All appliances, with the exception of cookers, are assumed to be connected to a chimney.

A3.5.3 **Reliability**

The type of EFV being considered is a simple device. The reliability of EFVs is not known with sufficient confidence to predict the behaviour of a large population of valves in service for tens of years; however growing populations exist in other countries from which reliability data is beginning to emerge. Data on reliability currently available does not indicate any problems for a correctly specified and installed valve.

A3.5.4 **Summary**

On the basis of the above, and for the purposes of this appendix, it can be assumed that:

- the installation of an EFV does not increase risk, it reduces risk, or on failure has no effect on risk
- EFVs can be assumed to be reliable.

APPENDIX 4 : REGULATION 6 OF DSEAR

The following is an extract from DSEAR and is reproduced for ease of reference.

Note: For further information see HSL138.

- (1) Every employer shall ensure that risk is either eliminated or reduced so far as is reasonably practicable.*
- (2) In complying with his duty under paragraph (1), substitution shall preferably be undertaken, whereby the employer shall avoid, so far as is reasonably practicable, the presence or use of a dangerous substance at the workplace by replacing it with a substance or process which either eliminates or reduces the risk.*
- (3) Where it is not reasonably practicable to eliminate risk pursuant to paragraphs (1) and (2), the employer shall, so far as is reasonably practicable, apply measures, consistent with the risk assessment and appropriate to the nature of the activity or operation –*
 - (a) to control risks, including the measures specified in paragraph (4); and*
 - (b) to mitigate the detrimental effects of a fire or explosion or the other harmful physical effects arising from dangerous substances, including the measures specified in paragraph (5).*
- (4) The following measures are, in order of priority, those specified for the purposes of paragraph (3)(a) –*
 - (a) the reduction of the quantity of dangerous substances to a minimum;*
 - (b) the avoidance or minimising of the release of a dangerous substance;*
 - (c) the control of the release of a dangerous substance at source;*
 - (d) the prevention of the formation of an explosive atmosphere, including the application of appropriate ventilation;*
 - (e) ensuring that any release of a dangerous substance which may give rise to risk is suitably collected, safely contained, removed to a safe place, or otherwise rendered safe, as appropriate;*
 - (f) the avoidance of –*
 - (i) ignition sources including electrostatic discharges; and*
 - (ii) adverse conditions which could cause dangerous substances to give rise to harmful physical effects; and*
 - (g) the segregation of incompatible dangerous substances.*
- (5) The following measures are those specified for the purposes of paragraph (3)(b) –*
 - (a) The reduction to a minimum of the number of employees exposed;*
 - (b) The avoidance of the propagation of fires or explosions;*
 - (c) The provision of explosion relief arrangements;*
 - (d) The provision of explosion suppression equipment;*
 - (e) The provision of plant which is constructed so as to withstand the pressure likely to be produced by an explosion; and*
 - (f) The provision of suitable personal protective equipment.*
- (6) The employer shall arrange for the safe handling, storage and transport of dangerous substances and waste containing dangerous substances.*
- (7) The employer shall ensure that any conditions necessary pursuant to these Regulations for ensuring the elimination or reduction of risk are maintained.*
- (8) The employer shall, so far as is reasonably practicable, take the general safety measures specified in Schedule 1, subject to those measures being consistent with the risk assessment and appropriate to the nature of the activity or operation.*

APPENDIX 5 : GUIDANCE ON ELECTRICAL SAFETY

This Section is intended to provide the gas engineer with an insight into requirements for electrical safety of a gas installation; in particular the requirements of BS 7671 with respect to equipotential bonding of network pipelines and installation gas pipework. Authority for the design of a building's electrical system rests with a qualified electrical engineer or other Competent Person working in accordance with BS 7671.

A5.1 GENERAL

In order to provide protection against electric shock, BS 7671 requires the creation within buildings of equipotential zones. Exposed extraneous metal components, i.e. those which could conduct electricity from outside the zone, need to be bonded to earth.

A5.2 BONDING

Bonding connections need to be made to hard pipe, free from paint or other covering, and not to any soft or flexible metal connections. The size of the bonding conductors have to be in accordance with BS 7671.

A5.2.1 Main equipotential bonding conductors have to be fitted to connect the following extraneous metal parts to the building's earthing system:

- above ground gas network and installation pipework
- water installation pipework
- other metal services such as oil pipes
- other extraneous metalwork such as ducts and HVE systems.

A5.2.2 There are two main locations for main equipotential bonding connections to gas pipes:

- (a) where the meter(s) and the point of entry are adjacent, the connection is made on the consumer's side of each meter
- (b) where the meter(s) are elsewhere, on the network pipeline or installation pipework at its point of entry into a building or dwelling. The equipotential bonding connection is made downstream of any insulating fitting.

In both cases, the connection needs to be made as close as practicable to but within 600 mm of the point of entry or the meter and before any branch connections. The bonding connection has to be in an accessible and visible position and fitted with a warning label stating "Safety Electrical Connection, Do not remove". The connection has to be mechanically and electrically sound and not subject to corrosion. See clause 542.3.2 of BS 7671.

A5.2.3 All electrical installation work has to comply with BS 7671 and be carried out in accordance with the Electricity at Work Regulations. Among the many requirements, the employer has to ensure that:

- staff are competent to carry out the work they are given
- safe working practices are adopted; and
- all electrical equipment including the electrical installation, are maintained in a safe condition.

The safety of persons using and maintaining the gas installation needs to always be considered.

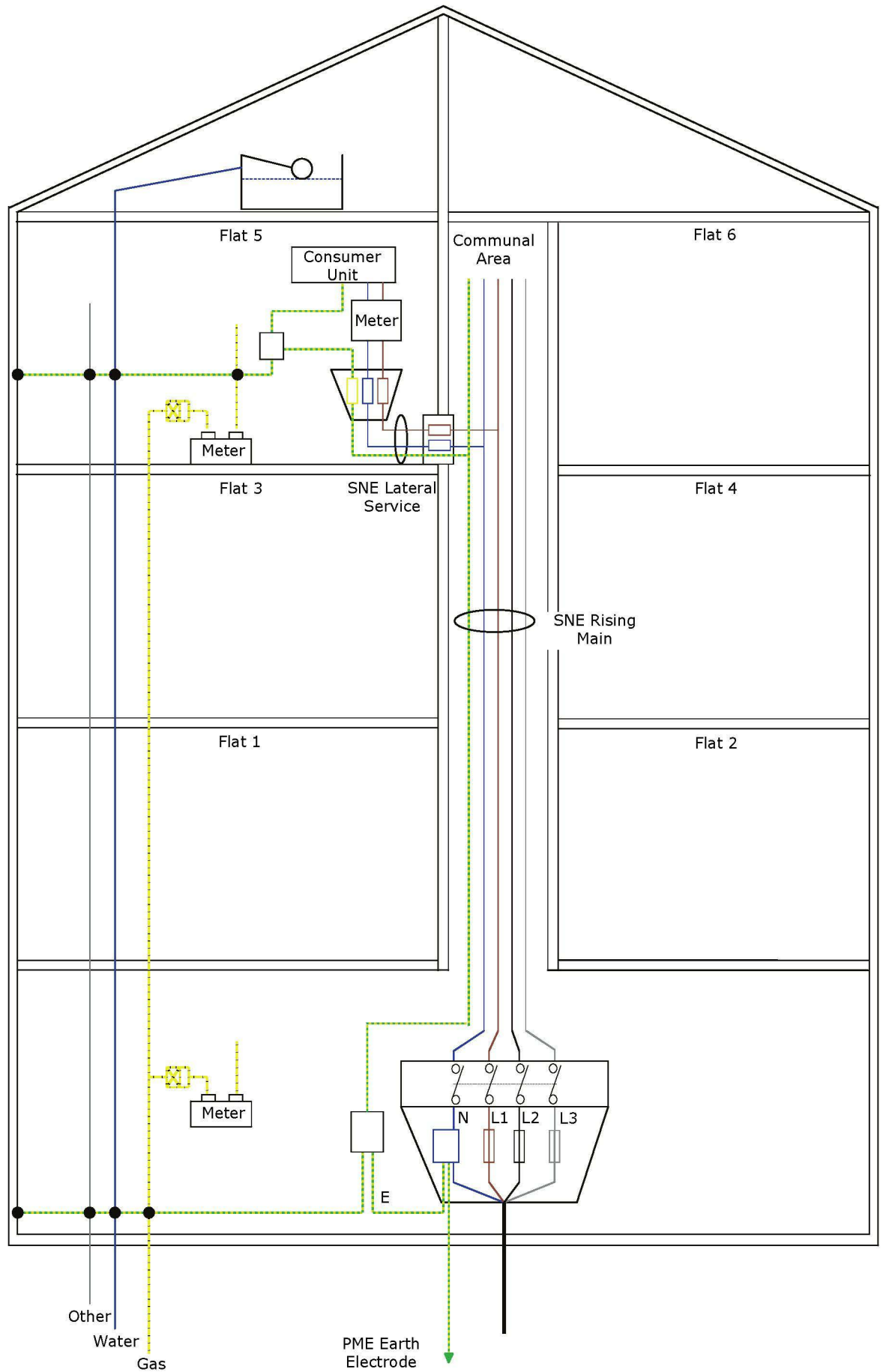
- A5.2.4 Where a meter bank and the point of entry are adjacent, the equipotential bonding needs to be fitted to the outlet of each meter according to clause A5.2.2 (a).

For internal installation pipework, where the meters are located elsewhere, the equipotential bonding connection needs to be made between the point of entry of the pipe into the building and the building's main earthing terminal according to clause A5.2.2 (b).

Where a network pipeline enters the building within a dwelling, the pipeline itself has to be bonded to the building's main earthing terminal as in clause A5.2.2 (b). In addition, the installation pipe within the flat has to be bonded to the dwelling's earthing terminal in accordance with clause A5.2.2 (a) or A5.2.2 (b) (see Figures 33, 34 and 35).

- A5.2.5 With both internal and external risers, equipotential bonding to the dwelling's earthing terminal needs to be fitted at the pipe's entry into each dwelling. The bonding connection needs to be:

- if a meter is located in each dwelling, to the outlet of the meter according to clause A5.2.2 (a), or
- if the meter is located elsewhere, at the pipe's entry into the dwelling, according to clause A5.2.2 (b)
- for meters in external meter boxes, preferably inside the building and as near as practicable to the installation pipe's entry into the building. Alternatively, the connection may be made within the box/housing, but it is essential that the bonding cable can neither become damaged nor its presence compromise the integrity of the box/housing and the sealing of any sleeve
- where a meter is, or meters are, installed in a separate building, equipotential bonding within the meter building has to be fitted to each meter according to clause A5.2.2 (a) (see Figure 39)
- where the installation pipe(s) enter the building from underground, insulating fittings or sleeving has to be provided and equipotential bonding according to clauses A5.2.2 (a) or A5.2.2 (b) needs to be applied at the point(s) of entry and/or in each dwelling as appropriate.



Note: This figure has been reproduced with the permission of the Energy Networks Association.

FIGURE 32 - BONDING ARRANGEMENTS FOR UTILITIES IN FLATS

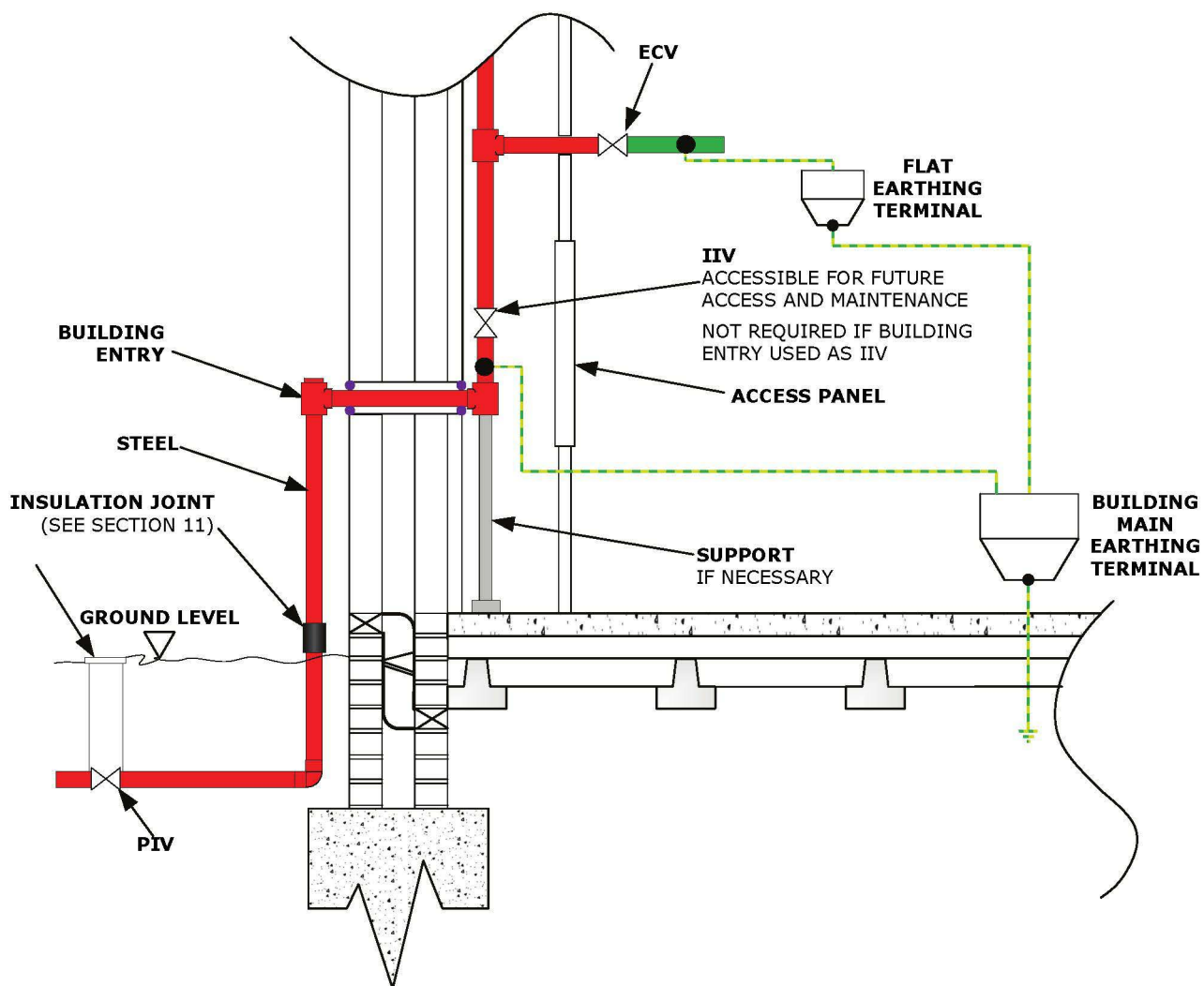


FIGURE 33 - ELECTRICAL BONDING FOR ABOVE-GROUND PIPELINE BUILDING ENTRY (STEEL PIPE)

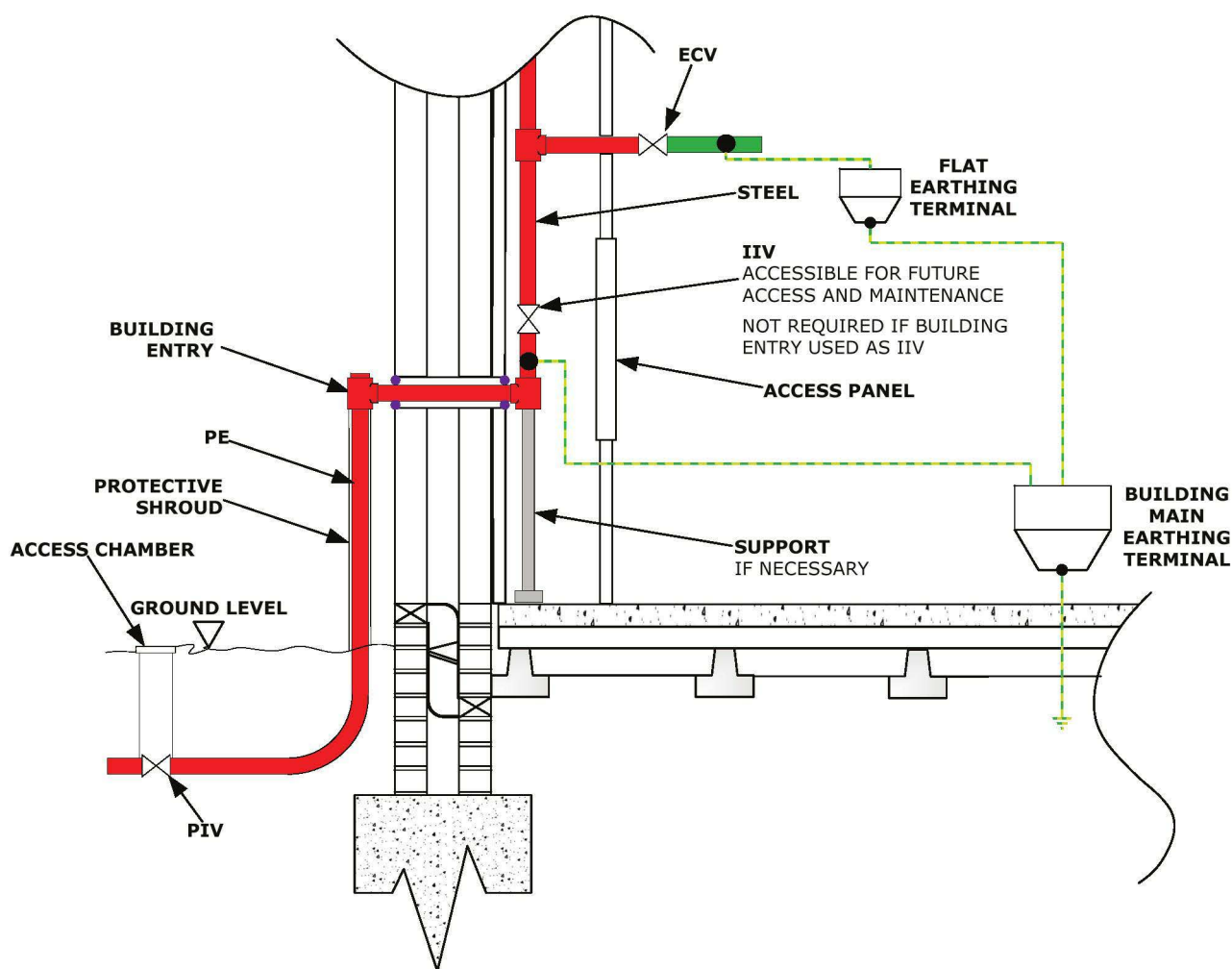
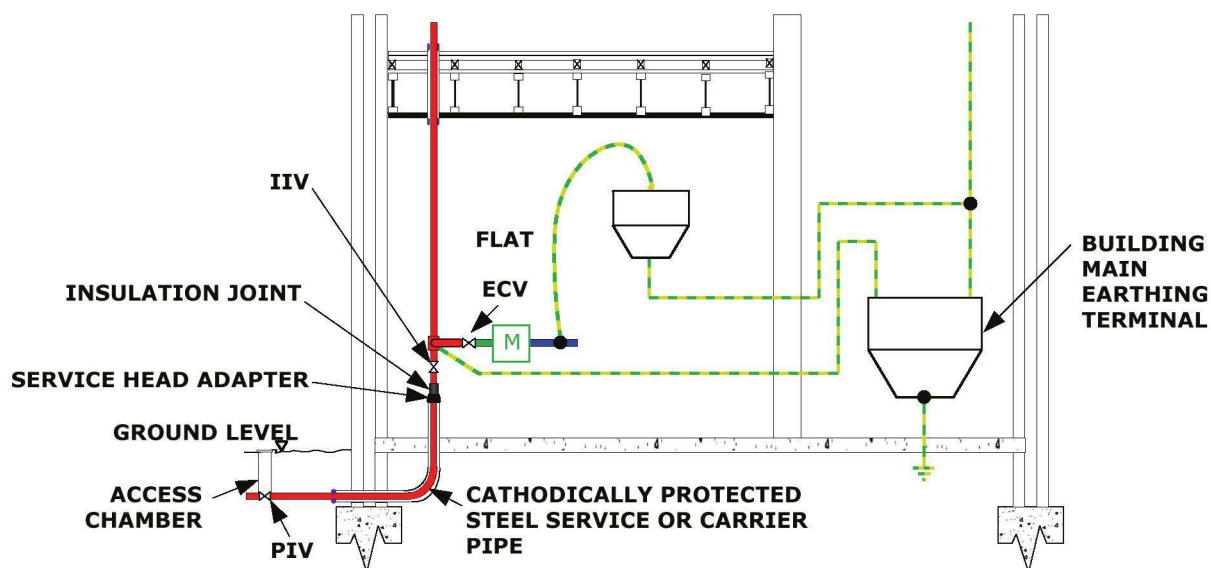
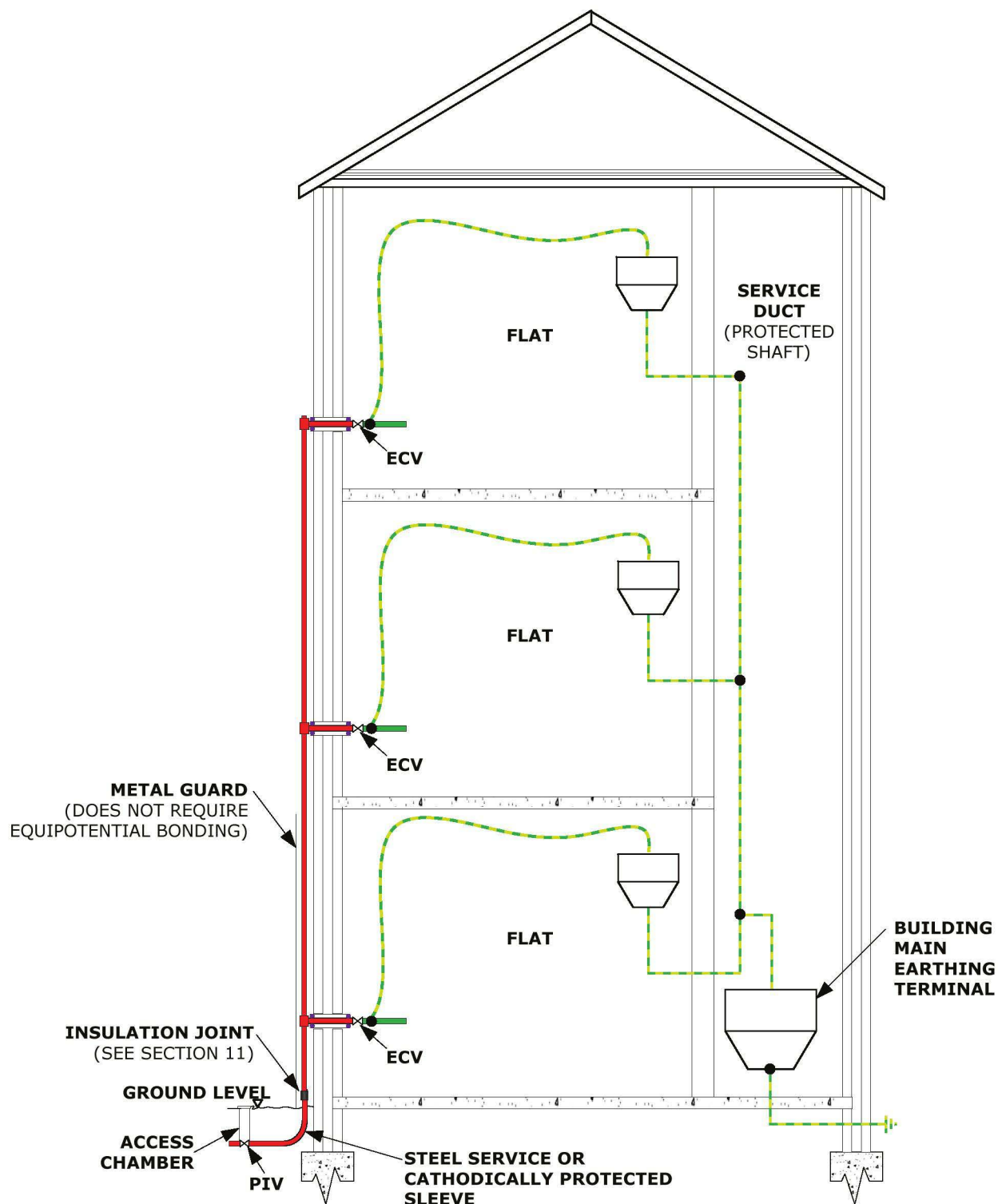


FIGURE 34 - ELECTRICAL BONDING FOR ABOVE-GROUND PIPELINE BUILDING ENTRY (PE PIPE UP TO BUILDING ENTRY)



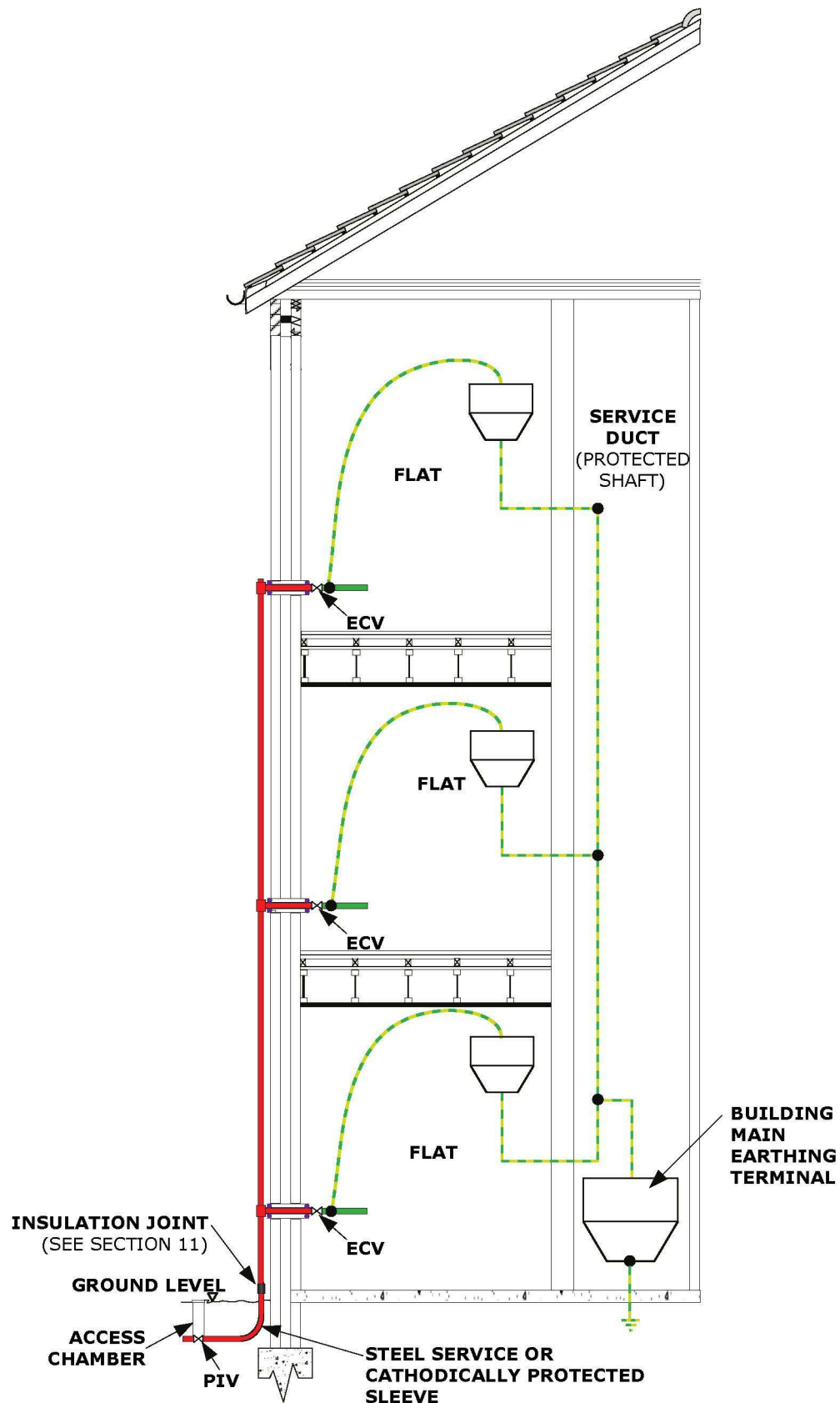
Note: Ventilation is not shown, for clarity.

FIGURE 35 - ELECTRICAL BONDING OF A BELOW-GROUND ENTRY SYSTEM AND INTERNAL RISER



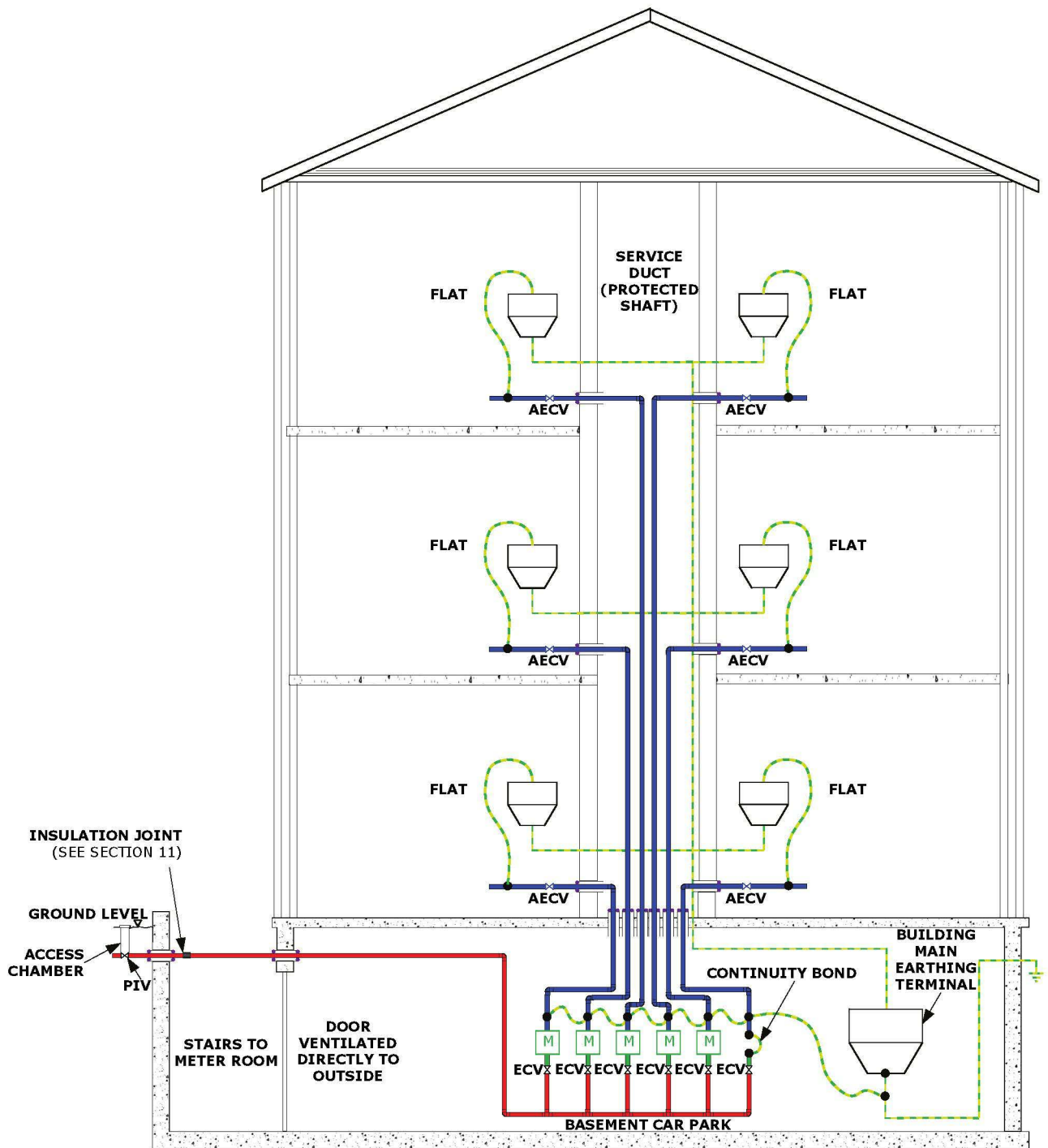
Note: Ventilation is not shown, for clarity.

FIGURE 36 - EQUIPOTENTIAL BONDING. EXTERNAL PE NETWORK RISER WITH GUARD AND CATHODICALLY PROTECTED BELOW-GROUND PIPE OR PROTECTION SLEEVE



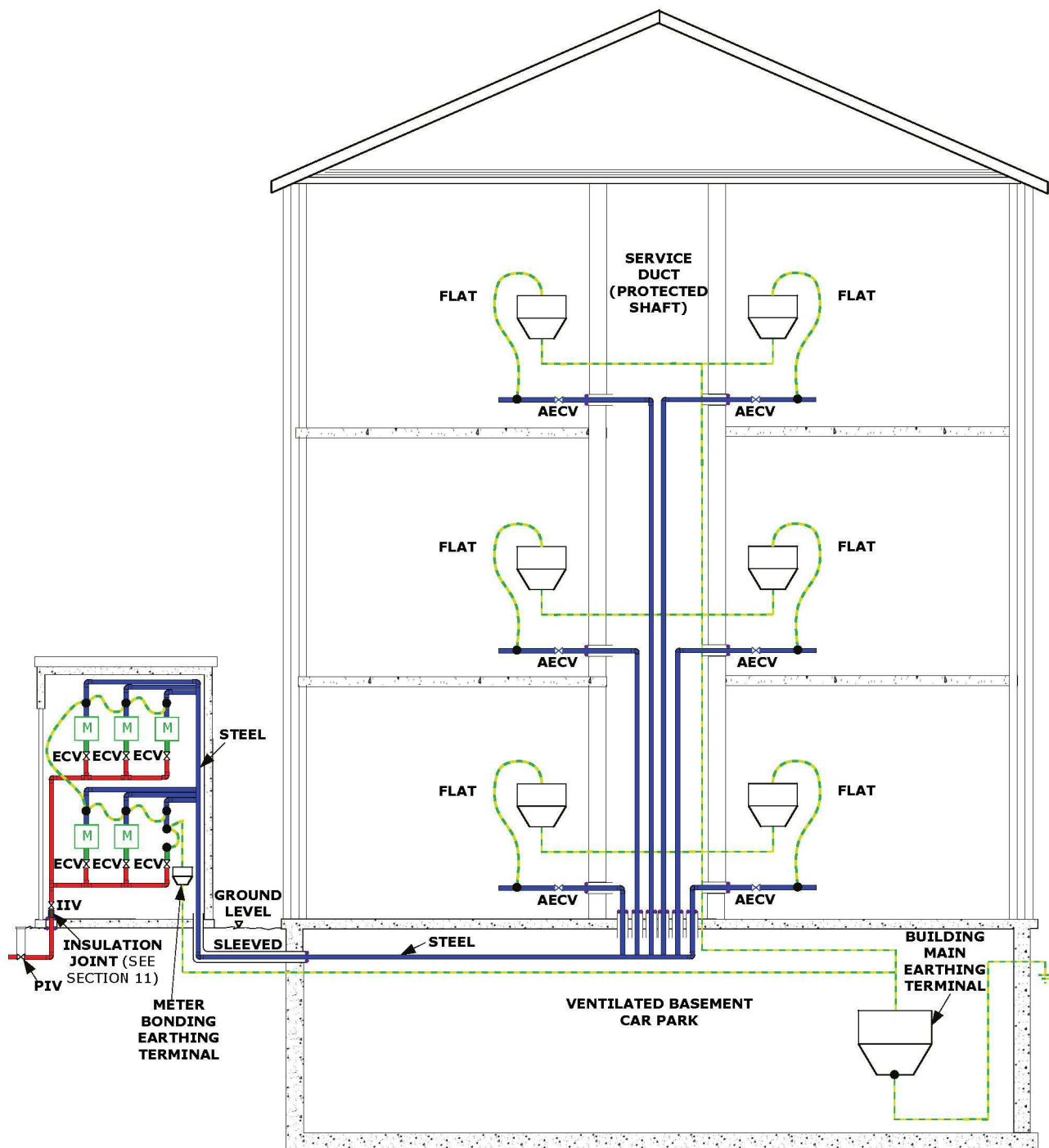
Note: Ventilation is not shown, for clarity.

FIGURE 37 - EQUIPOTENTIAL BONDING. EXTERNAL STEEL NETWORK RISER WITH CATHODICALLY PROTECTED BELOW-GROUND PIPE OR PROTECTION SLEEVE



Note: Ventilation is not shown, for clarity.

FIGURE 38 - EQUIPOTENTIAL BONDING. REMOTE METER INSTALLATION. INTERNAL METALLIC PIPEWORK - METERS IN SAME BUILDING



Note: Ventilation is not shown, for clarity.

FIGURE 39 - EQUIPOTENTIAL BONDING. REMOTE METER INSTALLATION. EXTERNAL BURIED PIPEWORK – METERS IN A SEPARATE BUILDING

APPENDIX 6 : TIMBER FRAMED BUILDINGS

GAP LOCATION	OPENING AND CLOSING GAPS (mm)	
	Floor joists	
	Solid timber (mm)	Engineered I-joist (mm)
Eaves/verge	Add 5 mm to gap dimension at level below	
Sixth storey	Specialist calculations to be submitted	61
Fifth storey		53
Fourth storey		45
Third storey	45	35
Second storey	35	25
First storey	20	15
Ground storey*	5	5

*Ground storey or lowest level of timber frame.

TABLE 13 - DIFFERENTIAL MOVEMENT OF TIMBER FRAMED BUILDINGS

The gap sizes are based on the following:

- timber joist and rim beam/header joist maximum depth 240 mm
- timber frame floor cross section is as shown below with maximum 45 mm deep timber plates/binders
- single head binder at the eaves. Maximum double sole plates
- calculations, where required, to be based on BS EN 1995-1-1
- timber components are not saturated and normal moisture contents at the time of construction (e.g. less than 20%) and tight jointed construction
- movement gaps in excess of 35 mm should be protected by cover strips
- the table allows for a 2 mm thickness of compressible material in closing gaps. Check the manufacturer's product details
- outer leaf brickwork with expansion rates no greater than 2.5 mm per storey
- brickwork up to 5 storeys with lightweight cladding above 5 storeys
- lightweight cladding - floor level joints to be 15 mm for solid timber and 10 mm for engineered I-joists
- the ground floor is concrete. For ground floors of timber joists add 15 mm for solid timber and 10 mm for engineered I-joists.

Note: Further guidance on installations in timber framed buildings is given in IGE/UP/7.