warranty
LABC

TECHNICAL MANUAL

VERSION 11

15: HEATING SERVICES

15. Heating Services

Contents

Limitations of Functional Requirements

1. These Functional Requirements do not and will not apply to create any policy liability for any remedial works carried out by the contractor or otherwise, nor to any materials used in those remedial works.
2. The guidance provided in this Section, is guidance that provides a suggested solution to meeting the Functional Requirements. If an alternative solution is selected, then this must still meet the Functional Requirements.

Workmanship

1. A commissioning certificate is required for any work completed by an approved installer.
2. All work is to be carried out by a technically competent person in a workmanlike manner.

Materials

1. All materials should be stored, installed and protected correctly in a manner that will not cause damage or deterioration of the product.
2. All materials, products and building systems shall be appropriately tested and approved for their intended purpose.

Design

1. Heating services - shall be designed, constructed and installed so that they:
    a. Are provided with evidence to demonstrate they meet the requirements of Building Regulations;
    b. Do not adversely affect the structural stability of the building;
    c. Prevent the entry of hazardous ground substances, external moisture or vermin;
    d. Are constructed using non-hazardous materials;
    e. Are durable and robust;
    f. Are safe and convenient in use;
    g. Insulated to prevent unintended heat losses;
    h. Capable of being adequately controlled.

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Heating Services

15.1
Associated Services for Space and Water Heating Systems

Provision of information

A full set of design drawings and specifications shall be made available to the Warranty Provider and all other interested parties prior to the associated works starting on site. This may include:

1. Fully detailed drawings for the proposed system.
2. Full specification for the elements of the system(s), which shall include but not be limited to:
   a) Any space/hot water system serving appliances, and associated elements of plant employed for the delivery of space heat or hot water services.
   b) Water storage cisterns and cylinders.
   c) Heat emitters and any associated controls.
3. Commissioning certification.
4. Post installation/completion testing requirements.

The Warranty Surveyor, at their discretion, may also request supporting information that demonstrates suitability for use of any materials or systems contained within the above.

Gas services supplied to the dwelling

Pipework serving up to and including the emergency control valve and meter should be installed in accordance with the requirements of the gas transporter, gas supplier and primary meter owner.

Electrical services supplied to the dwelling

Mains and services cable installations up to and including the meter should be in accordance with the requirements of the Utility provider.

Items to be taken into account include:

- Locations and fittings of pipes and cable service entries should be protected where passing through the substructure.
- Services must be sleeved or ducted through structural elements (and not solidly embedded) to prevent damage. Fire stopping may also be required. Services should not to be located in the cavity of an external wall, except for electricity meter tails.
- Services should only be buried in building fabric where permitted by relevant Codes of Practice.

Services entering into the building

Penetrations through the structural fabric into the building must not must not create a structural instability or diminish the durability of the surrounding building fabric.

Weather resistance

Penetrations through the external weather proof envelope must be appropriately sealed to ensure suitable weather resistance is achieved. Any fittings, components and/or sealants provided for this purpose must be installed in accordance with the manufacturer's recommendations.

Utility meters

External meter boxes should be of a type approved by the supply authority and located as close as practical to the main access point to the building.

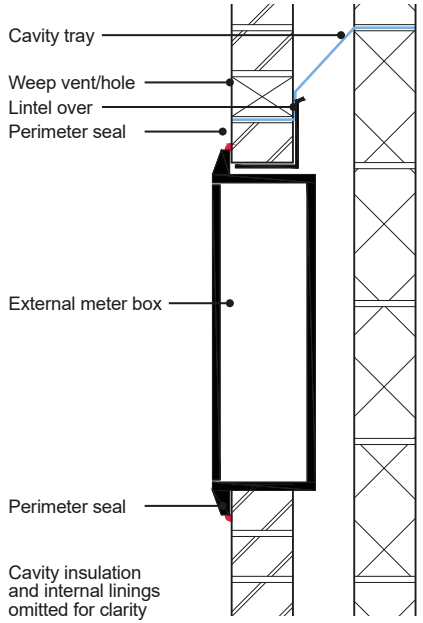
Domestic meters may be of the following type:

- Built-in to the outer leaf of the wall.
- Surface-mounted on an external wall.
- Semi-concealed: sunk into the ground adjacent to the outer wall.
- Individual, purpose-made compartments, in accordance with British Standards.

For further guidance, the respective Utility provider requirements should be followed in relation to type and acceptable installation of meter boxes e.g. installation height, external ductwork, fixing for connection purposes and they may recommend that reference is made to National Joint Utility Group Publications.

For Warranty purposes, any openings provided in walls for the installation of meters must be structurally sound, and their location must not create a structural instability where they are placed astride other structural openings e.g. doors and window openings. They must be provided with a lintel and increased wall tie frequency around the opening edges in line with the guidance in the 'External Walls' section.

The installation must also be suitably weatherproofed to prevent dampness entering the home by incorporating appropriate perimeter seals, a cavity tray and weep vents/holes above the opening.



Penetrations from gas pipework

Installation of pipework must comply with relevant Approved Codes of Practice and Industry standards, such as those published by the Institution of Gas Engineers and Managers (IGEM) or Gas Safe Register (GSR).

Note: Where gas pipework is to be installed in timber frame, allowance must be made for differential movement – see the 'External Walls – Timber Frame' section of this Technical Manual.

Penetrations from electrical cabling

Electrical services and installations must comply with the requirements of BS 7671 'Requirements for electrical installations' and comply with BS 6004 'Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting'.

Note: the passage of cabling under, against or within thermal insulation should be avoided, unless they have been appropriately sized and de-rated. Additionally, provision for separation should be made for any PVC covered cables to ensure they are not in contact with polystyrene insulation.

Materials

The recommendations of the water supplier with regard to materials and fittings used for water services should be followed. It may be necessary to fit aluminium protector rods in areas where the corrosion of copper cylinders occurs. These are to be fitted during manufacture, in accordance with the relevant British Standards.

Fire stopping

Where fire stopping is installed around services that penetrate fire-resisting floors, walls or partitions, all fire sealing and fire stopping materials used must be fully compatible with the pipes and/or cabling. Guidance on compatibility should be sourced from the manufacturers of interacting materials in the first instance.

Further general information on this can be found in the 'Upper Floors' and 'Internal Walls' guidance.

Installation of services

All items should be installed to ensure satisfactory operation.

Items to be taken into account include:

- Locations and fittings of pipes and cable service entries through the substructure.
- Services must be sleeved or ducted through structural elements (and not solidly embedded) to prevent damage.
- Fire stopping may also be required (see above).
- Services should not to be located in the cavity of an external wall, except for electricity meter tails.
- Only to be buried in screeds where permitted by relevant Codes of Practice.

For further guidance on electrical services, reference should be made to the 'Electrical Services' section.

Jointing of service supply pipes and fittings

Proprietary joints should be made strictly in accordance with the manufacturer's instructions.

For metal pipes, only flux recommended by the pipe manufacturer should be used and all traces should be removed immediately after jointing. Flux containing lead are not acceptable.

Suitable clips or brackets are to be used to secure pipes and fittings. Fixings should be installed adequately and spaced to stop sagging but not restrict thermal movement.

Sufficient room should be allowed for thermal expansion and contraction to avoid damage and noise from pipe movement.

Gas pipework contained within ducts

Ducts that contain gas pipework must be ventilated to ensure that any minor leakage of gas can be cleared to prevent a build-up reaching dangerous levels. For guidance on ventilation requirements, the installer should refer to BS 6891 'Specification for the installation and maintenance of low pressure gas installation pipework of up to 35 mm on premises'. Note: Ventilation of the duct should not be solely relied upon for mitigation in a major gas leak caused by a larger failure in the pipework.

Where gas pipework is contained within a duct which cannot be ventilated to the recommendations of the above standard, the provision of proprietary containment pipework – such as products which have a secondary outer cover to contain any escaping gas from the primary outer cover – should only be accepted where:

- Each end terminates to a point of safe and ventilated dispersal.
- The proprietary product has recognised 3rd Party Accreditation certification or suitable testing to a recognised Approved Code of Practice or Standard.
- Its use within the installation complies with relevant Approved Codes of Practice and Industry standards, such as those published by the Institution of Gas Engineers and Managers (IGEM) or Gas Safe Register (GSR).

Chasing of masonry cavity walls

If chases in walls are necessary, their depth should not exceed:

- One-sixth the thickness of the single leaf for horizontal chases.
- One-third the thickness for vertical chases.

Hollow blocks should not be chased unless specifically permitted by the manufacturer.

Pipework in walls

If the services are hidden in walls, they need to be positioned so that any significant cracking of the surface cannot occur. A metallic tape should be applied to the pipework where plastic pipework is hidden within or behind wall surfaces, which would otherwise not be located by a metal detector.

Services within structural floors

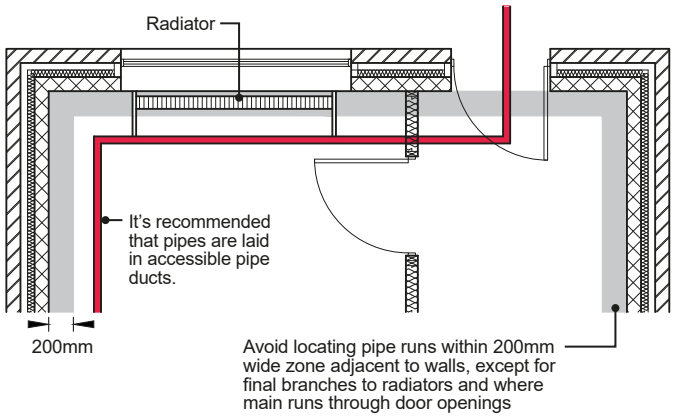
Services should not be incorporated within structural floors or structural screeds.

Pipework in non-structural floor screeds

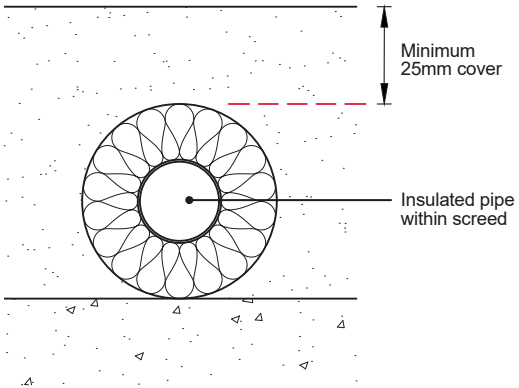
If the services are hidden in floors, they need to be positioned so that any significant cracking of the surface cannot occur. Where copper pipes are permitted in floor screeds, they should be:

- Sleeved or wrapped so that they can move freely along the length and at joints and bends.
- Jointed with capillary joints.

Recommended positioning of pipes in non-structural screeds



Recommended positioning of pipes in non-structural screeds



Screed cover should be a minimum 25mm over the pipe and insulating materials. The screed thickness should still be at least 25mm where pipes cross over.

Notches and drillings

Solid timber floor joists should not be excessively notched or drilled to allow the passage of services - further information can be found in the 'Upper Floors' section.

Services passing through 'Engineered floor joists' e.g. I-joists, open metal web joists, laminated beams, etc. must follow published guidance from the joist manufacturer.

Cutting or alteration of the flange of an engineered floor joist is strictly prohibited – where this occurs, the engineered joist must be replaced.

15.
Heating Services

15.2
Conventional Space and Water Heating Systems

Space heating systems

Where space heating systems are provided, evidence will be required to demonstrate that it is compliant with the requirements of relevant Building Regulations and the guidance of relevant Approved Codes of Practice and industry standards to ensure safe operation.

Where appropriate, space heating systems should comply with the following:

- BS EN 12828 'Heating systems in buildings. Design for water-based heating systems'.
- BS 8303 'Installation of domestic heating and cooking appliances burning solid mineral fuels'.
- BS 5410 'Code of practice for oil firing'.
- BSRIA guide BG 4/2011 'Underfloor heating and cooling'.
- BS 5410 'Code of practice for oil firing'
- EN 14336 'Heating systems in buildings. Installation and commissioning of water based heating systems.'

Where space heating is delivered via a domestic wet central heating systems and incorporates a gas fired boiler, reference should be made to BS 6798 'Specification for selection, installation, inspection, commissioning, servicing and maintenance of gas-fired boilers of rated input not exceeding 70 kW net'.

Space heating delivered by electric boilers serving a wet central heating systems should reference manufacturer's guidance for specification, installation, and commissioning.

Space heating appliances, including all components and controls, should be of a type approved by the relevant authority and their relevant equipment testing & approval schemes.

Performance of space heating systems

Any whole-house heating system should be designed to meet internal temperatures to the levels set out as per below. External temperature is to be -2°C.

Air change rates given below are default values derived from the guidance of BS EN 12831-1 'Energy performance of buildings - method for calculation of the design heat load. Space heating load'.

Location	Temperature	Air changes
Living room	21°C	1 per hour
Dining room	21°C	1 per hour
Kitchen	18°C	2 per hour
Bedrooms	18°C	1 per hour
Bed-sitting room	21°C	1 per hour
Bathrooms	22°C	2 per hour
Hall and landing	16°C	2 per hour
Separate WC	18°C	2 per hour

Note: Space heating systems using low or zero carbon technologies only, e.g. Air source heat pumps, should follow the guidance in the 'Heating Services - Other Forms of Heating Systems Including Low and Zero Carbon Systems' section. Any designs using differing data values or system specific guidance than those given above must be fully rationalised within supporting calculations.

Designs must also make allowance for influencing factors, such as:

- The number of air changes per hour from kitchens and bathrooms should account for any mechanical ventilation.
- The presence of open flued appliances affecting the rate of air change. Where this occurs, air change rates used for the design should be increased in accordance with BS EN 12831.
- Design temperatures should be verified by calculations and not by performance tests.
- The main living room should have a heating appliance or a heat output as part of a whole home heating system.

Design and installation of hot water services

Evidence shall be provided that the design and installation is compliant with the requirements of the relevant Building Regulations and the guidance of relevant Approved Codes of Practice and industry standards to ensure safe operation, and be adequate for the demand and consumption.

Where appropriate, systems delivering hot water services should comply with the following:

- BS EN 806 Parts 1-5 'Specifications for installations inside buildings conveying water for human consumption'.
- BS8558 'Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complementary guidance to BS EN 806'.

Storage vessels

Should be:

- Accessible for maintenance,
- Installed as per manufacturers recommendations,
- Insulated, and adequately supported.

Where an immersion heater is fitted, it should be:

- Appropriate for the type of water supplied to the building.
- Thermostatically controlled.
- Located so that it can be withdrawn for replacement.
- Fitted with an accessible on/off switch.

Protection against freezing

Cisterns, vent pipes and all water services in unheated spaces should be insulated against freezing as specified in the design.

Insulation is not to be placed below a cold water tank where it can benefit from heat from beneath. Tanks that are raised need to be insulated on all sides in an unheated roof space.

Fully insulated bends and junctions are required, especially near openings to the outside air, such as the eaves. If possible, water pipes should not be located within a loft space where they could be affected by cold ventilation air.

Provision for expansion

An expansion pipe is to be provided on vented systems for hot water.

Unvented hot water systems

Third-party accreditation is required where an unvented hot water system with a storage capacity greater than 15 litres is required by the design. Installation is to be completed by a competent person.

Draining down facility

Hot water installations require the capability to be drained down.

Controls – Space heating

Space heating and hot water service appliances should have controls as determined by the specialist heating design. Dependant on the chosen and specified system, such controls may include but are not limited to:

- Zone controls.
- Time and temperature controls.
- Boiler interlocks.
- Controls for space heating and controls for hot water.

Maintenance

All system installations must have safe access provided to all elements requiring routine inspection, periodic servicing/maintenance, repair and periodic functional checks in relation to performance inclusive of any switchgear, inverters, meters and controls in accordance with the manufacturer's recommendations.

Testing and commissioning

All systems must be tested and commissioned in accordance with a commissioning schedule.

Evidence should be provided in the commissioning schedule for:

- Identification of the systems to be commissioned.
- Identification of commissioning activities for each area of the system and installation.
- A list of documentation requirements associated with the commissioning process.
- A list of documents which will be handed over at completion of testing and commissioning.

The testing and commissioning of the system must prove and demonstrate that the installation is in accordance with the certification requirements, the manufacturer's recommendations and the design.

Upon completion, the installer must provide a certificate to confirm that the system has been installed, tested and commissioned in accordance with the above.

Completion of works

Upon completion of work, the installer must provide evidence of an information pack, which includes:

- User instructions for the systems installed.
- Contact details for the manufacturer and installer.
- All information in relation to the key components installed.
- Maintenance and servicing requirements.
- Any Warranties and/or guarantees relating to appliances and associated kit.

15.
Heating services

15.3
Other Forms of Heating Systems Including Low and Zero Carbon Systems

This section provides guidance on how low or zero carbon systems may be acceptable to meet the Functional Requirements of this Technical Manual, for:
- Air source heat pumps.
- Ground source heat pumps.
- Solar photovoltaics (PV).
- Solar thermal water heating.
- Wind turbines.
- Biomass boiler.

Alternative systems that follow the general principles of this sub section will be subject to specific agreement.

Provision of information

A full set of design drawings and specifications shall be made available to the Warranty Provider and all other interested parties prior to the associated works starting on site. This may include:

1. Fully detailed design and installation suite of documents for the proposed system, which shall include:
   a) A drawing package inclusive of schematics covering positions of appliances, plant, associated pipework and/or electrical cabling.
   b) Manufacturer specification for all appliances and elements of plant.
   c) A clear matrix document indicating interfacing systems and which manufacturer and/or installer is responsible for each system and the resultant interface(s).
   d) Fixing schedules.
   e) Specification for controls.
   f) Commissioning certification.
   g) Post installation/completion testing requirements.
   h) An operation and maintenance manual for each system and interfacing elements.
   i) SAP assessment documentation to demonstrate the Building Fabric performance for the building supports the inclusion of such heating systems.

The Warranty Surveyor, at their discretion, may also request supporting information that demonstrates suitability for use of any materials or systems contained within the above.

Design and specification

All 'low or zero carbon technology systems' and products must have current certification confirming satisfactory assessment by an appropriate independent authority that is acceptable to our Warranty.

Systems and products assessed through the Microgeneration Certification Scheme (MCS) will be acceptable for Warranty purposes, subject to:

Any electricity generating technologies with a capacity of up to 50kW and heat generating technologies with a capacity of up to 45kW (including any method of attachment to the building) must:
- Hold certification with the 'Microgeneration Certification Scheme (MCS)', AND
- The installers must also be registered with the 'Microgeneration Certification Scheme (MCS)'.

Designs and location of components should take account of:
- Internal and external noise.
- Vibration.
- Penetrations through the weather proof fabric.
- Loading onto the structure, any system components requiring foundations or anchorage into structure must be designed by an Engineer.
- Positioning in relation to openings.
- Potential encroachment across defined access routes.

Designs should ideally be supplied from one manufacturer as a package and not as individual components or materials. However, where components from more than one manufacturer are used, they should be compatible to ensure the satisfactory design performance is achieved.

Note:
1. Where a Low or zero carbon technology system is installed as a **secondary** system i.e. to contribute towards the primary space and water heating system to the building, they should be designed so that the overall heating system meets the performance requirements within 'Heating Services – Conventional Space and Water Heating Systems'.
2. Where a low or zero carbon technology system provides the main **primary** space and water heating system: users must be aware how the system works differently to a conventional heating system and be clearly explained to them on handover, to ensure how to run the system efficiently.
3. Any assessment of the performance of a space heating system must avoid comparisons with conventional heating systems e.g. gas boilers. If a systems performance must be measured, it should be done so against a comparable system benchmark using the same technologies to avoid misconceptions that these systems are not being as responsive or are failing to meet the required performance levels.

Installation

All system installations must have current certification confirming satisfactory assessment by an appropriate independent authority.

All installations must:
- Be carried out by certified installers, trained to an acceptable level for the system(s) being installed. Installers certified in accordance with the MCS installer standards will generally be acceptable.
- Installation information issued by the system manufacturer and system designer must be followed.
- Be able to prove and demonstrate a clear Quality Assurance procedure for the installation.

Where installation involves more than one installer e.g. where 2 or more different systems interface, a clear statement must be provided to clearly communicate which installer is responsible for each system and all associated interfacing.

Installations or work to systems containing fluorinated gas must use operatives that are F-Gas qualified and all individual operatives must have a qualification as an individual from an accredited organisation e.g. City and Guilds, Building Engineering Services Association (BESA), LCL Awards, Construction Industry Training Board (CITB).

Typically this will occur on Air Source Heat Pumps that are part of 'split systems' e.g. smaller outdoor units plus an indoor unit and may also incorporate a hot water cylinder.

All electrical installations must:
- Comply with BS 7671 'Requirements for Electrical Installations'.
- Be in accordance with the 'Electrical Services' section of this Technical Manual.

Electrical systems and installations which generate electricity and are connected to the mains should automatically disconnect when there is a mains power failure. This is to avoid them from feeding the network or local distribution system during a planned or unscheduled loss of mains supply.

All pipework installations must:
- Comply with relevant codes and standards or be independently assessed for their intended use.
- Use materials suitable for the intended purpose and provide satisfactory performance for the life of the system. Any refrigerant pipework should be of refrigerant quality copper pipe, or other material as recommended by the manufacturer.

Where there is a risk of pipes freezing, they should be insulated. The insulation material must be:
- Inert, durable, and resistant to the effects of moisture.
- In-line with relevant codes and standards or be independently assessed for their intended use.
- Incorporate a vapour control layer to prevent ice build-up when employed on refrigerant pipework.

Any system components fixed to the building structure must:
- Be fully designed and assessed by an Engineer with regards to the buildings ability to accept the loadings and prevent detrimental effects arising from additional loading, movement or vibration.
- Be in accordance with the manufacturer's recommendations in relation to the type, size, number, position and fitting tolerance of fixings.
- Utilise fixings made from durable materials in accordance with recognised standards.
- Not adversely affect the weather resistance of the building.
- Fixings, supports, bracketry and mounting frames for components should be capable of taking designated loads in accordance with the manufacturer's recommendations.
- Have adequate protection against corrosion. Where two metals are to be joined, they should either be compatible or isolated, to prevent bimetallic corrosion. Aluminium and aluminium alloys should not come into contact with cementitious material.

Any system components penetrating through the building structure/fabric must:
- Be formed and detailed to provide adequate weather resistance.
- Be sealed to limit air leakage and prevent moisture from reaching the interior or any part of the structure that could be adversely affected by its presence.
- Must be weatherproofed using appropriate flashings and fixings where detailing requires e.g. solar photovoltaic panels and pitched roofing.
- Not include weatherproofing details that rely solely on sealant.
- Be robustly formed and sealed to inhibit the passage of fire and smoke where deemed required by relevant Building Regulations.

Maintenance

All system installations must have safe access provided to all elements requiring inspection, periodic servicing/maintenance, repair and periodic functional checks in relation to performance inclusive of any switchgear, inverters, meters and controls in accordance with the manufacturer's recommendations.

The electrical installation should be capable of being isolated from all other electrical sources when required, for maintenance or testing.

Testing and commissioning

The testing and commissioning of the system must prove and demonstrate that the installation is in accordance with the certification requirements, the manufacturer's recommendations and the design.

Upon completion, the installer must provide a certificate to confirm that the system has been installed, tested and commissioned in accordance with the above.

Completion of works

Upon completion of work, the installer must provide an information pack, which includes:
- A completed manufacturer's certificate from an acceptable independent assessment organisation, MCS or suitable alternative that is acceptable to our Warranty.
- User instructions for the systems installed.
- Contact details for the manufacturer and installer.
- All information in relation to the key components installed.
- Details of the fuel type and source.
- Maintenance and servicing requirements.
- Any Warranties and/or guarantees relating to appliances, items of plant and associated kit.

The information pack should clearly explain how to operate the system efficiently and provide a clear explanation on what to expect from the installed system. This is of particular importance for users whom are more accustomed to gas boiler systems and the differences they may experience in operation.

For clarity, these differences should identify if a system is likely to be not as responsive; radiators (if installed) feeling cooler to the touch albeit that rooms still reach the target temperature as designed and the differences in using an alternate means of control e.g. no provision of on/off timers to control space heating.

Heat pumps

A device which takes heat energy from a low temperature source and upgrades it to a higher temperature at which it can be usefully employed for heating and/or hot water. Heat pumps may utilise different heat sources:

- Ground Source, where heat energy is extracted from the ground (e.g. from boreholes, horizontal trenches or aquifers)
- Water Source, in which heat energy is extracted from water (e.g. lakes, ponds or rivers)
- Air Source, where heat energy is directly extracted from ambient air.

Equipment certification
On request, manufacturers of equipment shall be able to produce evidence of the operation of a documented quality control system that has been assessed and meets with the requirements of the Microgeneration Certification Scheme (MCS).

Assessment specific to equipment should be aligned with the relevant Microgeneration Certification Scheme:

- MCS 007 - MCS Product Certification Scheme Requirements: Heat Pumps (Single Heat Pumps up to 45KWth)
-

All installed equipment must carry the 'MCS Certification Mark'.

Design, installation and commissioning
All work carried out shall be executed in accordance with the relevant MCS Microgeneration Installation Standards:

- MIS 3005 D & MIS 3005 I Requirements for MCS Contractors undertaking the supply, design, installation, set to work, commissioning and handover of Microgeneration Heat Pump Systems, and
- Provide evidence that the system will meet a level of performance required by the relevant Building Regulations.

Installations or work to systems containing fluorinated gas must use operatives that are F-Gas qualified and all individual operatives must have a qualification as an individual from an accredited organisation e.g. City and Guilds, Building Engineering Services Association (BESA), LCL Awards, Construction Industry Training Board (CITB).

Typically this will occur on Air Source Heat Pumps that are part of 'split systems' e.g. smaller outdoor units plus an indoor unit and may also incorporate a hot water cylinder.

General considerations
Radiators and pipework that are used with these systems are likely to be larger than that of traditional gas boilers.

As well as the size of pipework, pipe runs will need to follow the specific schematics issued by the designer of the system to ensure they deliver the flow rates expected. Changes of direction in pipework may give rise to a reduced flow rate where they do not follow the specific system schematics and specifications.

Oversizing components can result in significantly reduced efficiency and therefore any equipment that forms part of a designed system will have been calculated to ensure that it is not oversized for its space heating load. For this reason, substitution of the specified equipment within a designed system must be avoided.

Similarly, the location and positioning of equipment should be exactly as illustrated upon schematics, notably where air flow is key around installed equipment and is also essential in avoiding clashes with other elements. It is also paramount to ensure that positioning allows for periodic maintenance to be carried out by providing sufficient access to installed equipment.

Any assessment of the performance of a space heating system must avoid comparisons with conventional heating systems e.g. gas boilers. If a systems performance must be measured, it should be done so against a comparable system benchmark using the same technologies to avoid misconceptions that these systems are not being as responsive or are failing to meet the required performance levels.

Key points of note are that radiators, when installed as part of heat pump systems, will feel cooler to the touch. This should not be considered as a failure of the systems performance where the designed room temperature is ultimately achieved within the designated response time for the space to achieve its target temperature.

Heating systems that incorporate heat pumps will typically use different approaches to managing temperatures, with simple on/off timer control of conventional space heating being replaced with controls that are more suited to the system e.g. 'setback' temperature strategy. This is where a limiting temperature (a temperature that you never want the conditioned space to fall below) is set for the system and a target temperature is also set (the temperature for use of the space at chosen points in the day, as per the specific design).

Impact on the building structure
Underground systems must not undermine or otherwise impact on building foundations due to proximity or operation. Any system designs must be carried out alongside foundation designs and engage any relevant parties in the foundation design at an early stage.

A site specific calculation for assessment of loading will be required where equipment is mounted onto building fabric i.e. placed on a flat roof, or attached to an external wall. This is applicable even where an approved mounting system kit is utilised.

Weather resistance
Where equipment is attached to the building fabric it must be provided with detailing that does not allow rainwater to run back towards the building or create staining. Where employed, weather shielding attachments must direct water away from the structure. Where services or product attachment creates a penetration of the weatherproof envelope, all detailing must be weather tight and should not solely rely on the use of sealants.

Solar photovoltaics (PV)

Solar photovoltaic (PV) systems use module arrays to generate electricity from sunlight which are mounted on a roof(s) and/or walls using mounting systems.

Module types are:

- Monocrystalline or polycrystalline silicon PV modules.
- Amorphous thin film PV modules.
- Bespoke Building-integrated PV modules - PV glazing, PV façade units or PV shading units.
- Hybrid PV modules.

PVs are generally about 1m x 1.5m and are connected in series as an 'array' to achieve a desired energy output.

Equipment certification
On request, manufacturers of equipment shall be able to produce evidence of the operation of a documented quality control system that has been assessed and meets with the requirements of the Microgeneration Certification Scheme (MCS).

Assessment specific to equipment should be aligned with the relevant Microgeneration Certification Scheme:

- MCS 005 - MCS Product Certification Scheme Requirements: Solar PV Modules.
- MCS 012 – MCS Product Certification Scheme Requirements: Pitched Roof Installation Kits.
- MCS 017 – MCS Product Certification Scheme Requirements Bespoke Building Integrated PV Products.

All installed equipment must carry the 'MCS Certification Mark'

Design, installation and commissioning
All work carried out shall be executed in accordance with the relevant guidance:

- MCS/ECA – Guide to the Installation of Photovoltaic Systems
- And, provide evidence that the system will meet a level of performance required by the relevant Building Regulations.

Panels and all associated components inclusive of fixings must meet the fire performance requirement of the relevant Building Regulations.

General considerations
The efficiency of PV is dependent on positioning and achieving the maximum exposure to sunlight of the panels. Factors that affect this are orientation and the angle of the roof on which they are fixed.

The ideal roof angle depends on the location of the home but generally 30° elevation is the optimum in the UK.

Durability
Where PV units form part of the weather proof envelope they must achieve the same service life as the roof covering (25 years).

Components must be checked they are suitable for durability where used in Coastal locations due to the aggressive conditions components will be exposed to.

Impact on the building structure
Structural assessment must be provided to prove and demonstrate the structures ability to accommodate the additional loads transmitted from the PV modules, associated mounting systems, and any battery storage placements on or within the roof structure or associated voids.

Any assessment should also consider the potential loads created by wind and snow. For each site the imposed wind and snow loads should be derived using the procedures within Eurocode 1 (BS EN 1991-1). Wind loads vary considerably across the UK and are influenced by factors such as site altitude, building height and local topography.

Recognised test data commissioned for the specific purpose of determining the wind loads on such systems should be used to create any calculations.

Weather resistance
Where equipment is attached or mounted to the building fabric, it must be provided with detailing that does not allow rainwater to enter the building fabric via structural connections, cabling or pipework penetrations. All detailing must be weather tight and should not solely rely on the use of sealants.

Flat roof PV module arrays that are supported on a framework must incorporate suitable protection to the flat roof waterproofing and be designed alongside flat roof drainage provision. Support structure and any associated system i.e. ballasted bases must not create an imposition to the drainage of the flat roof or compromise the waterproof roof covering.

Solar thermal water heating

Solar thermal panels or solar collectors are devices that are mounted on to your roof to absorb the sun's heat and use it to heat up water, stored in a cylinder.

Equipment certification
On request, manufacturers of equipment shall be able to produce evidence of the operation of a documented quality control system that has been assessed and meets with the requirements of the Microgeneration Certification Scheme (MCS).

Assessment specific to equipment should be aligned with the relevant Microgeneration Certification Scheme:

- MCS 004 - MCS Product Certification Scheme Requirements: Solar Collectors
- MCS 012 – MCS Product Certification Scheme Requirements: Pitched Roof Installation Kits

Alternatively, solar collector equipment may be listed under the CEN Solar Keymark scheme.

All installed equipment must carry the 'MCS Certification Mark'

Design, installation and commissioning
All work carried out shall be executed in accordance with the relevant guidance:

- MIS 3001 – Requirements for MCS Contractors undertaking the supply, design, installation, set to work, commissioning and handover of Solar Heating Microgeneration Systems.
- And, provide evidence that the system will meet a level of performance required by the relevant Building Regulations.

Durability
Where Solar thermal water heating system units form part of the weather proof envelope they must achieve the same service life as the roof covering (25 years).

Components must be checked they are suitable for durability where used in Coastal locations due to the aggressive conditions components will be exposed too.

Impact on the building structure
Structural assessment must be provided to prove and demonstrate the structures ability to accommodate the additional loads transmitted from Solar Heating equipment, associated mounting systems and the potential loads created by wind and snow. For each site the imposed wind and snow loads should be derived using the procedures within Eurocode 1 (BS EN 1991-1). Wind loads vary considerably across the UK and are influenced by factors such as site altitude, building height and local topography. Recognised test data commissioned for the specific purpose of determining the wind loads on such systems should be used to create any calculations.

Weather resistance
Where equipment is attached or mounted to the building fabric, it must be provided with detailing that does not allow rainwater to enter the building fabric via structural connections, cabling or pipework penetrations. All detailing must be weather tight and should not solely rely on the use of sealants.

Flat roof Solar Heating equipment arrays that are supported on a framework must incorporate suitable protection to the flat roof waterproofing and be designed alongside flat roof drainage provision. Support structure and any associated system i.e. ballasted bases must not create an imposition to the drainage of the flat roof.

Wind turbines

Wind turbines use propeller-like blades of a turbine around a rotor, which spins a generator, which creates electricity into battery storage.

Types may be:

- Roof mounted wind turbines.
- Pole-mounted wind turbines.
- Micro domestic turbine.

Equipment certification
On request, manufacturers of equipment shall be able to produce evidence of the operation of a documented quality control system that has been assessed and meets with the requirements of the Microgeneration Certification Scheme (MCS).

Assessment specific to equipment should be aligned with the relevant Microgeneration Certification Scheme:

- MCS 006 - MCS Product Certification Scheme Requirements: Small Wind Turbines (up to 50kW output).

Design, installation and commissioning
All work carried out shall be executed in accordance with the relevant guidance:

- MIS 3003 – Requirements for Contractors undertaking the supply, design, installation, set to work, commissioning and handover of Micro and Small Wind Turbine Systems.
- And, provide evidence that the system will meet a level of performance required by the relevant Building Regulations.

Impact on the building structure
Structural assessment must be provided to prove and demonstrate the structures ability to accommodate the additional loads transmitted from the associated mounting systems. Where wind turbines are pole mounted to or through fabric, the rotational effects creating by pole mounted equipment should also be considered.

Any battery storage placements on or within the roof structure or associated voids should also be considered within any structural assessment.

Weather resistance
Where equipment is attached or mounted to the building fabric, it must be provided with detailing that does not allow rainwater to enter the building fabric via structural connections, cabling or pipework penetrations. All detailing must be weather tight and should not solely rely on the use of sealants.

Biomass systems

Biomass systems burn natural materials such as wood pellets, chips or logs to provide space heating and power to hot water services.

Equipment certification
On request, manufacturers of equipment shall be able to produce evidence of the operation of a documented quality control system that has been assessed and meets with the requirements of the Microgeneration Certification Scheme (MCS).

Assessment specific to equipment should be aligned with the relevant Microgeneration Certification Scheme:

- MCS 008 - MCS Product Certification Scheme Requirements: Biomass.

Design, installation and commissioning
All work carried out shall be executed in accordance with the relevant guidance:

- MIS 3004 – Requirements for Contractors undertaking the supply, design, installation, set to work, commissioning and handover of Biofuel Heating Systems.
- MCS Guidance Document – Percussive Events Guidance.
- And, provide evidence that the system will meet a level of performance required by the relevant Building Regulations.

Impact on the building structure
Structural assessment must be provided for the additional loads and any foundation requirements for the installation of heavy plant related to biomass equipment. For further guidance, please refer to the 'Foundations' section.

Weather resistance
Where equipment passes through building fabric, it must be provided with appropriate seals and weathering detailing that does not allow rainwater to enter the building fabric or act in a manner that is detrimental to the structural or weatherproofing of that element of fabric. Detailing should not solely rely on the use of sealants.

Relevant standards

- BS EN 12975-1 'Thermal solar systems and components. Solar collectors'.
- BS EN 12976-1 'Thermal solar systems and components. Factory made systems'.
- BS EN 61215 'Terrestrial photovoltaic (PV) modules - design qualification and type approval'.
- BS EN 14511 Parts 1-4 'Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling'.
- BS EN 61400-1'Wind turbines'.
- BS EN 61400-2'Wind turbines. Small wind turbines'.
- BS EN 14785 'Residential space heating appliances fired by wood pellets'.
- BS EN 12809 'Residential independent boilers fired by solid fuel'.
- BS EN 303-5 'Heating boilers for solid fuels, hand and automatically fired, nominal heat output of up to 300kW. Terminology, requirements, testing and marking'.

Microgeneration Certification Scheme (MCS)

All references to any Microgeneration Certification Scheme (MCS), and any associated guidance and/or literature produced by the MCS, is considered correct at the time of publishing.

As low and zero carbon technologies are a developing area of construction, users are advised to access and use the most up-to-date versions of this guidance when undertaking design, specification, installation and commissioning of any such systems. Please visit the Microgeneration Certification Scheme (MCS) website for further information.

It should also be noted that any other certification schemes or regulation bodies that are introduced in the future, and in addition to the Microgeneration Certification Scheme (MCS) may be acceptable for Warranty, but only when subject to agreement with the Warranty Provider or we introduce supplementary information.

T 0800 183 1755 **E** enquiries@labcwarranty.co.uk **labcwarranty.co.uk**

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