
Part 3

Ancillary technologies

■ 3.1 Low or zero carbon technologies



Chapter 3.1

Low or zero carbon technologies



3.1 Low or zero carbon technologies

CONTENTS

	Clause	Page
INTRODUCTION		1
Biomass boilers		1
Heat pumps		1
Solar photovoltaics		1
Solar thermal water heating		1
Wind turbines		1
DEFINITIONS FOR THIS CHAPTER		1
DESIGN		
Design Standards	D1	2
Statutory requirements	D2	2
Certification	D3	2
System design	D4	2
Building integration	D5	2
Electrical requirements	D6	3
Discharge	D7	3
Insulation of pipework	D8	3
Ground collectors	D9	3
Refrigerant pipework	D10	3
Fuel storage	D11	3
Clean Air Act	D12	3
Access	D13	4
Provision of Information	D14-D15	4
MATERIALS		
Materials standards	M1	4
Standards	M2	4
Fixings	M3	4
Flashings	M4	4
Pipes and insulation	M5	4
SITWORK		
Sitework standards	S1	4
Competancy of installers	S2	4
Sequence of work	S3	5
Location	S4	5
Fixing	S5	5
Stability	S6	5
Weather resistance	S7	5
Access	S8	5
Handling, storage and protection	S9	5
Testing and commissioning	S10	5
Handover requirements	S11	5
APPENDIX 3.1 - A		6
Additional information		
INDEX		6

SCOPE

This Chapter gives guidance on meeting the Technical Requirements and recommendations for low or zero carbon (LZC) technologies.

INTRODUCTION

This Chapter gives guidance on low or zero carbon (LZC) technologies acceptable to NHBC.

Other systems that follow the general principles of this Chapter may also be acceptable subject to specific agreement with NHBC.

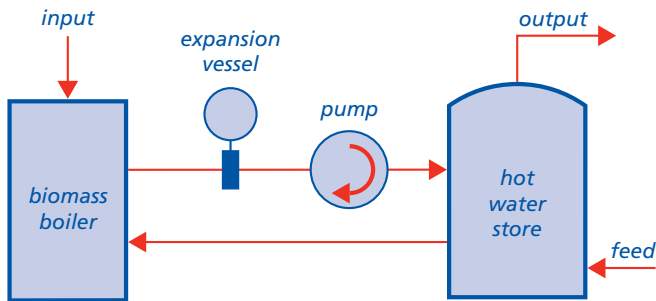
Additional requirements for solid fuel and oil fired boilers are given in Chapter 6.8 'Fireplaces, chimneys and flues'. Guidance on other internal services is given in Chapter 8.1 'Internal services'.

The illustrations provided within the Introduction are generic and do not indicate the only possible systems acceptable to NHBC.

The LZC technologies covered in this Chapter include:

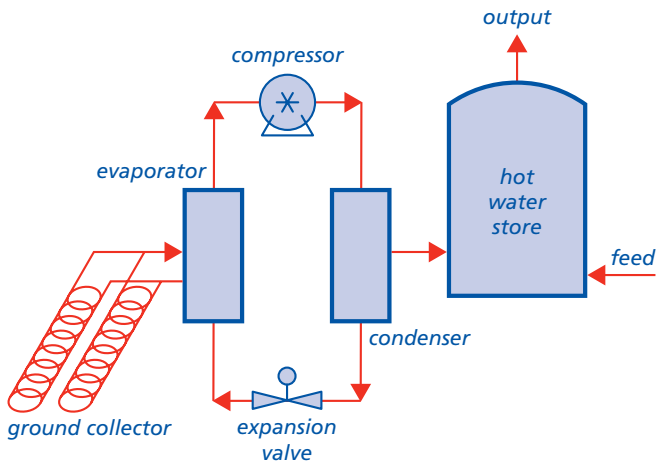
BIOMASS BOILERS

Biomass boilers burn wood pellets or wood chips for space and/or water heating.



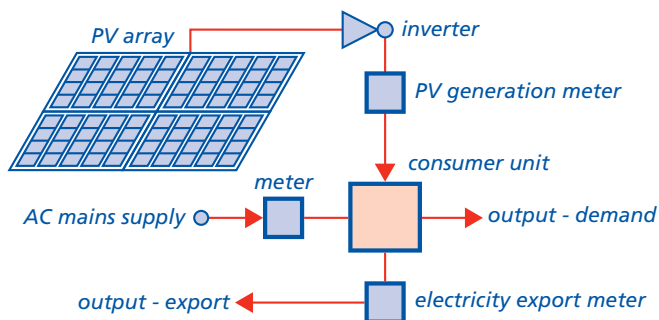
HEAT PUMPS

Heat pump systems provide space and/or water heating by transferring heat from a low temperature heat source. The most common heat sources are the ground, outdoor air or exhaust air.



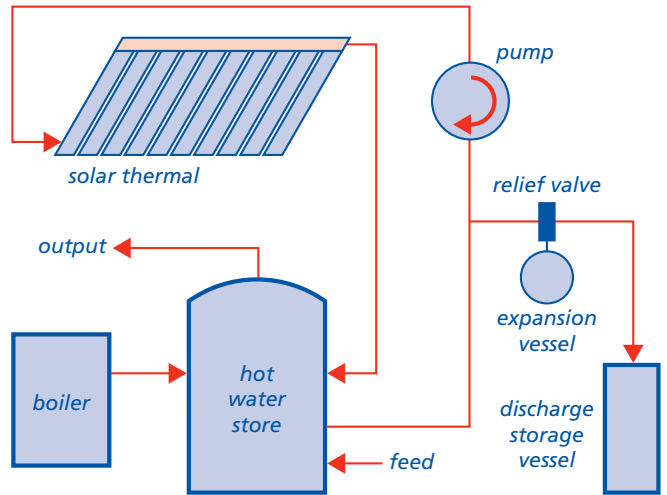
SOLAR PHOTOVOLTAICS

Solar Photovoltaic (PV) systems convert solar radiation into electricity.



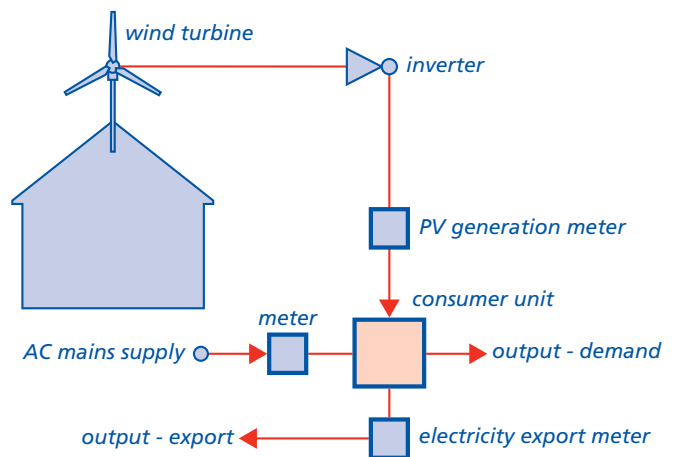
SOLAR THERMAL WATER HEATING

Solar thermal systems harness solar radiation for space and/or water heating.



WIND TURBINES

Wind turbine systems convert energy from the wind into electricity.



DEFINITIONS FOR THIS CHAPTER

CONTROLS

Controls are used to operate and/or regulate the system and may be electrical or mechanical.

EXCLUSION ZONE

An area where entry is restricted during periods when maintenance is in progress, to prevent risk of injury or loss of life.

FIXING

A component which is used to attach the LZC technology to the structure.

FLASHING

A piece of material, usually metal, plastic or composite, installed to prevent water from penetrating the building.

GROUND COLLECTORS

The component of a ground source heat pump system which absorbs heat from the ground. Collectors can be installed either horizontally or vertically in the ground. They may also be incorporated into proprietary foundation systems.

INTERFACE

Interconnection between two or more components.

INTERSTITIAL CONDENSATION

Condensation occurring within or between the layers of the building envelope.

INVERTER

A device that convert direct current into alternating current.

ISLANDING (ISLAND MODE OPERATION)

Where a LZC technology feeds the network or local distribution system during a planned or unscheduled loss of mains supply.

LOW OR ZERO CARBON (LZC) TECHNOLOGIES

A term applied to renewable sources of energy and also to technologies which are significantly more efficient than traditional solutions or which emit less carbon in providing heating, cooling or power.

METER

Device that measures consumption and/or generation of energy.

OPEN LOOP SYSTEM

A heat pump system that extracts water from an underground source, pumps it through a heat exchanger and returns it underground.

PARALLEL ELECTRICAL GENERATION

A system in which building loads can be fed simultaneously from the national grid or electricity supply grid and on-site sources such as wind turbines and photovoltaic panels.

PERFORMANCE

The manner or quality of functioning for a material, product or system.

REFRIGERANT PIPEWORK

Carries refrigerant between the indoor and outdoor unit of a split system. Normally made of copper and must be insulated and protected from damage.

RENEWABLE ENERGY

Energy from naturally available sources that can be replenished including energy from the sun, the wind and tides, and from replaceable matter such as wood or other plant material.

SPLIT SYSTEM

A type of heat pump in which the condenser is located indoors, the evaporator is located outdoors, and the two are linked by refrigerant pipework.

SURFACE CONDENSATION

Condensation occurring on surfaces of the building.

SWITCHGEAR

The combination of electrical switches, fuses and/or circuit breakers used to isolate electrical equipment.

VAPOUR CONTROL LAYER

A material that restricts the passage of water vapour into the construction to reduce the risk of interstitial condensation.

DESIGN STANDARDS**3.1 - D1 Design shall meet the technical requirements**

Design that follows the guidance below will be acceptable for LZC technologies.

STATUTORY REQUIREMENTS**3.1 - D2 Design shall comply with all relevant statutory requirements**

Design should be in accordance with relevant Building Regulations and other statutory requirements.

CERTIFICATION**3.1 - D3 Low or zero carbon technologies shall be certified in accordance with appropriate standards**

LZC technologies should have current certification confirming satisfactory assessment by an appropriate independent technical approvals authority acceptable to NHBC.

System products and installations that are assessed and certified through the Microgeneration Certification Scheme (MCS) will normally be acceptable to NHBC.

Further details of MCS can be found at:

| www.microgenerationcertification.org

Other certification bodies or test documentation may be acceptable if they are considered by NHBC to be a suitable alternative.

When requested by NHBC the certification and relevant test documentation should be made available.

SYSTEM DESIGN**3.1 - D4 Low or zero carbon technologies shall be designed to ensure satisfactory performance**

Items to be taken into account include:

(a) location

The output from certain LZC technologies may be affected by factors such as orientation, roof pitch, shading and geographical location.

For stand-alone wind turbine systems suitable exclusion zones should be provided in accordance with the manufacturer's recommendations.

(b) systems

Each system should generally 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 satisfactory performance.

(c) performance

LZC technologies should be designed in accordance with the manufacturer's recommendations and the certification scheme requirements and standards.

LZC technologies designed to contribute towards space and water heating should be designed in accordance with the performance requirements in Chapter 8.1 'Internal services' (Design).

(d) compatibility

Systems should be compatible with the building. Multiple systems should also be compatible with each other.

(e) acoustic performance

The design and location of LZC technologies should take account of noise and vibration. Both internal noise and external noise should be considered. The effect on neighbouring properties should be considered, particularly the relative positioning of openings in relation to the LZC technology.

(f) drawings and specifications

Drawings and specifications should indicate clearly which manufacturer and/or installer is responsible for each system, including interfaces.

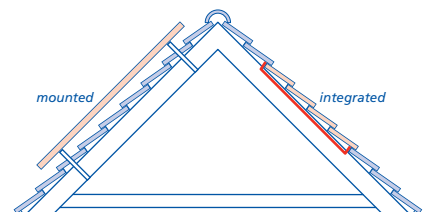
BUILDING INTEGRATION**3.1 - D5 Low or zero carbon technologies shall not adversely affect the stability or weather resistance of the building**

Items to be taken into account include:

(a) structural integrity

The design of the structure to which the LZC technologies will be attached should take account of:

- the self-weight of the LZC components
- imposed loads
- wind loads
- snow loads
- dynamic loading (where relevant).



Foundations for stand-alone LZC technologies should be designed by an Engineer in accordance with Technical Requirement R5.

Where stand-alone systems are installed the foundations and anchor points should be designed to withstand the structural forces acting upon them.

Wind turbines should be designed in accordance with BS EN 61400.

(b) supporting structure

The structure to which the LZC technology is attached should be assessed to ensure that it is able to accept the design loadings and prevent detrimental effects arising from movement or vibration.

(c) fixings

Fixings, supports, bracketry and mounting frames should be designed to accommodate all static and dynamic loads in accordance with the manufacturer's recommendations.

Fixings, supports, bracketry and mounting frames should be designed to take account of ventilation and drainage requirements of the LZC technology.

(d) weather resistance

The interface between the LZC technology and the building should be designed to ensure that moisture is prevented from reaching the interior, or any part of the structure that could be adversely affected by its presence.

To ensure satisfactory performance, the interface of a roof or wall integrated system and the part of the roof covering or wall cladding it replaces should be weatherproofed by appropriate flashings and sealed to limit air leakage.

Weatherproofing details that rely solely on sealant are not acceptable.

(e) thermal bridging and condensation

To avoid the potential for surface and/or interstitial condensation, the design should take account of thermal bridging, particularly where any part of the system, including fixings, penetrates the thermal envelope of the building.

(f) corrosion protection

Metalwork used for fixings, supports, bracketry or mounting frames should have adequate protection against corrosion.

Where two metals are to be joined they should be compatible or isolated from each other to prevent bimetallic corrosion.

Aluminium and aluminium alloys should not come into contact with cementitious material.

ELECTRICAL REQUIREMENTS

3.1 - D6 The electrical installation shall be in accordance with relevant regulations

The electrical installation should comply with BS 7671 'Requirements for Electrical Installations'.

Where parallel electrical generation occurs, inverters should have a current Engineering Recommendation G83/1 Type Test certificate and comply with all other parts of ER G83/1 for standard

installations. Larger installations should comply with ER G59/2.

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

LZC technologies which generate electricity and are connected to the mains should automatically disconnect when there is a mains power failure. This is to prevent them from feeding the network or local distribution system during a planned or unscheduled loss of mains supply. This is known as 'islanding'.

DISCHARGE

3.1 - D7 Discharge from low or zero carbon technologies shall terminate safely

Discharge from solar thermal water heating systems should be into a storage vessel. The vessel and discharge pipework should be suitable to withstand high temperatures.

All air source systems should incorporate an automatic defrost cycle and suitable condensate drainage.

INSULATION OF PIPEWORK

3.1 - D8 Pipework shall be designed to prevent freezing

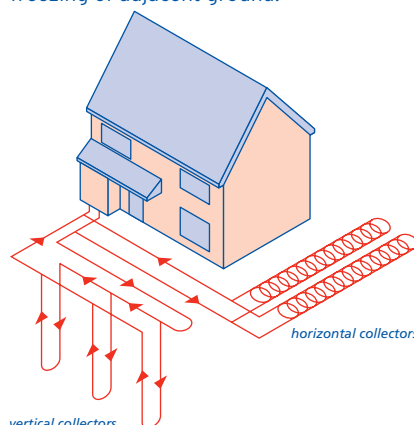
Where there is a risk of pipes freezing, they should be insulated, particularly when at, or close to, ground level.

GROUND COLLECTORS

3.1 - D9 Ground collectors shall be installed with regard for structural and environmental factors

Excavations for the installation of ground collectors should not adversely affect aquifers, foundations, drainage, water supply pipes and other services. Design should take account of local planning authority guidance including where excavations are close to trees and hedgerows (see Chapter 4.2 'Building near trees').

The design of ground collectors should specify their depth and layout to avoid freezing of adjacent ground.



Where open loop systems are proposed, consultation with the Environment Agency, Northern Ireland Environment Agency or Scottish Environment Protection Agency, as appropriate, should be made.

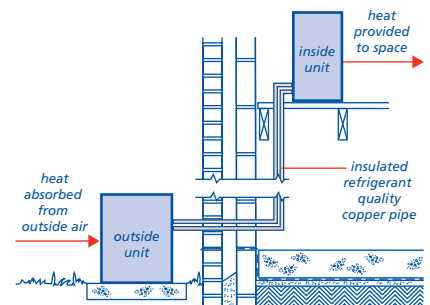
Open loop systems may require one or more of the following:

- a licence to investigate groundwater
- an abstraction licence
- a discharge consent.

REFRIGERANT PIPEWORK

3.1 - D10 Refrigerant pipework shall be designed to ensure adequate performance

Refrigerant pipework connecting split systems should be of refrigerant quality copper pipe or other material as recommended by the manufacturer. The pipe should be insulated and the insulation should incorporate a vapour control layer to prevent ice build-up.



FUEL STORAGE

3.1 - D11 Fuel storage for biomass boilers shall be suitable for the installation

The location of fuel storage should take account of access for delivery.

Fuel stores should:

- be of a suitable size to take account of peak load and period of demand
- have fire detection and extinguishing equipment where elevated dust levels are expected
- have appropriate fire resistance and separation to prevent fire and gases entering other parts of the building, where they are integral.

Guidance is given in The HVCA Guide to Good Practice Installation of Biofuel Heating (TR/38).

CLEAN AIR ACT

3.1 - D12 Biomass boilers installed in smoke controlled areas shall comply with relevant legislation

Biomass boilers that are to be installed within a smoke controlled area should comply with the Clean Air Act 1993 or Clean Air (Northern Ireland) Order 1981.

ACCESS

3.1 - D13 Appropriate arrangements shall be provided for the purposes of cleaning, inspection, maintenance and repair of low or zero carbon technologies

Design should take account of safe access to the LZC technologies, including switchgear, inverters, meters and controls, for cleaning, inspection, maintenance and repair of systems.

PROVISION OF INFORMATION

3.1 - D14 Designs and specifications shall be produced in a clearly understandable format and include all relevant information

Designs and specifications should include:

- full set of current drawings
- manufacturers' specifications
- fixing schedule
- interfaces
- controls
- on-site testing
- commissioning schedule.

3.1 - D15 All relevant information shall be distributed to appropriate personnel

Designs and specifications should be issued to consultants, relevant specialist subcontractors, site supervisors and/or suppliers as appropriate.

MATERIALS STANDARDS

3.1 - M1 All products and materials shall:

- (a) meet the Technical Requirements
(b) take account of the design

Products and materials that comply with the design and the guidance below will be acceptable for LZC technologies.

Products and materials for LZC technologies should comply with all relevant standards, including those listed below. Where no standards exist, Technical Requirement R3 applies (see Chapter 1.1 'Introduction to the Standards and Technical Requirements').

References to British Standards and Codes of Practice include those made under the Construction Products Directive (89/106/EEC) and, in particular, appropriate European Technical Specifications approved by a European Committee for Standardisation.

PRODUCTS

3.1 - M2 Products used for low or zero carbon technologies shall be adequate for their location and intended use

Relevant standards include:

- BS EN 12975-1– Thermal solar systems and components. Solar collectors. General requirements

- BS EN 12976-1 – Thermal solar systems and components. Factory made systems. General requirements
- BS EN 61215 – Crystalline silicon terrestrial photovoltaic (PV) modules. Design qualification and type approval
- BS EN 61646 – Thin film terrestrial photovoltaic (PV) modules. Design qualification and type approval
- 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. Design requirements
- BS EN 61400-2 – Wind turbines. Design requirements for small wind turbines
- BS EN 14785 – Residential space heating appliances fired by wood pellets. Requirements and test methods
- 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.

FIXINGS

3.1 - M3 Fixings shall be of durable material and provide satisfactory performance

Fixings should be manufactured from:

- phosphor bronze
- silicon bronze
- stainless steel to BS EN ISO 3506
- mild steel with coatings to BS EN 12329, BS EN ISO 2082, BS EN 1461, or other appropriate treatment in accordance with BS EN ISO 12944 or BS EN ISO 14713
- aluminium alloy to BS EN 573 and BS EN 755.

Stainless steel should comply with BS EN 10088. Mild steel should be galvanised in accordance with BS EN 10346.

Materials that comply with recognised Standards, which provide equal or better performance to those above, would also be acceptable.

Other materials should be assessed in accordance with Technical Requirement R3.

FLASHINGS

3.1 - M4 Materials for flashings shall provide satisfactory performance

The following are acceptable as flashings:

- rolled lead sheet (at least code 4) complying with BS EN 12588
- aluminium and aluminium alloys to BS EN 485 and BS EN 573 (0.6mm to 0.9mm thick) and protected from contact with mortar by a coating of bituminous paint
- zinc alloys to BS EN 988 and 0.6mm thick

- copper to BS EN 1172 and 0.55mm thick fully annealed.

Where two metals are to be joined they should be compatible and not cause bimetallic corrosion in that environment. Alternatively they should be isolated from each other.

Proprietary flashing kits and flashings, including plastic and composite, should be assessed in accordance with Technical Requirement R3.

PIPES AND INSULATION

3.1 - M5 Pipes and insulation shall provide satisfactory performance

Materials used for pipes and insulation should be suitable for the intended purpose and provide satisfactory performance for the life of the system.

Pipes should comply with relevant codes and standards or be independently assessed for their intended use in accordance with Technical Requirement R3.

Insulation materials should be inert, durable and should not be adversely affected by moisture or vapour. They should also comply with relevant codes and standards or be independently assessed for their intended use in accordance with Technical Requirement R3.

SITWORK STANDARDS

3.1 - S1 All sitework shall:

- (a) meet the Technical Requirements
(b) take account of the design
(c) follow established good practice and workmanship

Sitework that complies with the design and guidance below will be acceptable for LZC technologies.

All relevant information suitable for the use of installers should be available on site before work on the LZC technology starts, including:

- full set of current drawings
- manufacturer's specification
- fixing schedule
- details of all interfaces and controls
- on-site testing regime
- commissioning schedule.

COMPETENCY OF INSTALLERS

3.1 - S2 Systems shall be installed by competent operatives

Systems should be installed by operatives who:

- are competent and familiar with the system being installed, and

- can demonstrate that they have been trained in accordance with the MCS installer standards, or other suitable scheme acceptable to NHBC.

The installation, including interfaces, should be in accordance with the design.

SEQUENCE OF WORK

3.1 - S3 Low or zero carbon technologies shall be installed in accordance with a suitable schedule

To ensure performance, certain LZC systems and ancillary components should be installed in a logical and timely sequence in accordance with the manufacturer's recommendations.

LOCATION

3.1 - S4 Low or zero carbon technologies shall be correctly located

LZC technologies, including ancillary components should be located and identified in accordance with the manufacturer's recommendations and the design.

FIXING

3.1 - S5 Low or zero carbon technologies shall be securely fixed

LZC technologies, including ancillary components should be fixed in accordance with the manufacturer's recommendations and the design.

The type, size, number and positioning of all fixings, including their fitting tolerance, should be in accordance with the manufacturer's recommendations and the design.

Particular attention should be given to:

- the provision of suitable locking nuts and washers
- the isolation of dissimilar metals
- the isolation of aluminium from cementitious material.

Notching, drilling or chasing of structural components to accommodate service pipes or cables should either comply with Chapter 8.1 'Internal services', or be designed by an Engineer in accordance with Technical Requirement R5.

STABILITY

3.1 - S6 The building structure shall be constructed to take account of the low or zero carbon technology being installed

LZC technologies should be installed so as not to adversely affect the stability of the building to which they are fixed, in accordance with the manufacturer's recommendations and the design.

WEATHER RESISTANCE

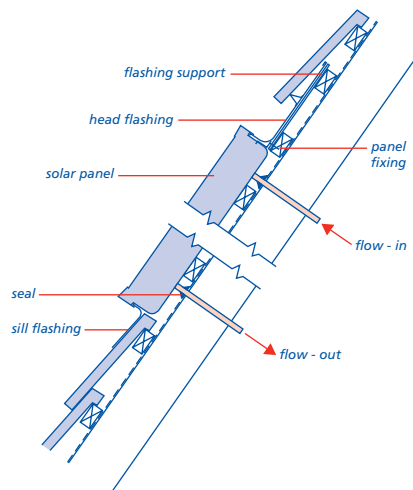
3.1 - S7 Low or zero carbon technologies shall not compromise the weather resistance of the building to which they are installed

LZC technologies should be installed in accordance with the manufacturer's recommendations and the design to ensure adequate weather resistance and limit air leakage.

The interface between the LZC technologies and the building should ensure that moisture is prevented from reaching the interior or any part of the structure that could be adversely affected by its presence.

Appropriate flashings and seals should be correctly installed in accordance with the manufacturer's recommendations and the design.

Interface weatherproofing details that rely solely on sealant are not acceptable.



ACCESS

3.1 - S8 Access to low or zero carbon technologies shall be provided in accordance with the design

Access to LZC technologies and ancillary components should be provided in accordance with the manufacturer's recommendations and the design.

HANDLING, STORAGE AND PROTECTION

3.1 - S9 Materials, products and systems shall be handled, stored and protected in a satisfactory manner to prevent damage, distortion, weathering and degradation

Items to be taken into account include:

(a) handling and storage

LZC technologies should be transported, lifted, handled and stored in accordance with the manufacturer's recommendations.

The delivery of products to site should be sequenced to avoid storage where possible.

(b) protection

Low or zero carbon technologies should be protected to avoid the risk of damage.

Ground collectors should be protected and tested prior to backfilling.

TESTING AND COMMISSIONING

3.1 - S10 Low or zero carbon technologies shall be tested and commissioned in accordance with the commissioning schedule

The installer should check:

- the safety of the system
- the correct installation of the system in accordance with the certification requirements, manufacturer's recommendations and the design
- the correct operation of the system in accordance with the certification requirements, manufacturer's recommendations and the design.

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

HANDOVER REQUIREMENTS

3.1 - S11 Detailed information including instructions shall be provided to the end user

The pack of information provided to the end user by the house builder should include:

- user instructions for the systems installed
- a completed manufacturer's certificate from an acceptable independent assessment organisation, MCS or suitable alternative
- a completed installer's certificate from an acceptable independent assessment organisation, MCS or suitable alternative.

The pack should also include:

- contact details for the manufacturer and installer
- key components installed
- fuel type and source
- maintenance and servicing requirements
- warranties and/or guarantees for the LZC technology.

3.1 Low or zero carbon technologies

APPENDIX 3.1-A

Additional information:

BS EN 12975-2: 2006	Thermal solar systems and components. Solar collectors. Test methods
BS EN ISO 14713: Part 1-4	Zinc coatings. Guidelines and recommendations for the protection against corrosion of iron and steel in structures
ER G59/2	Recommendations For The Connection Of Generating Plant To The Distribution Systems Of Licensed Distribution Network Operators
ER G83/1	Recommendations for the connection of small –scale embedded generators (up to 16 A per phase) in parallel with public low-voltage distribution networks
BRE Digest 489	Wind loads on roof –based photovoltaic systems
BRE Digest 495	Mechanical installation of roof-mounted photovoltaic systems
	The HVCA Guide to Good Practice Installation of Biofuel Heating (TR/38)
	The HVCA Guide to Good Practice Installation of Heat pumps (TR/30)
British Wind Energy Association	Small Wind Turbine Performance and Safety Standard
Photovoltaics in buildings	Guide to the installation of PV systems. 2nd Edition (DTI publication 06/1972)
CE72	Energy Efficiency Best Practice in Housing - Installing small wind-powered electricity generating systems
CE131	Energy Efficiency Best Practice in Housing - Solar water heating systems

INDEX

A		G		S	
Access	5	Ground collectors	3	Sequence of work	4
B		H		Solar photovoltaics	1
Biomass boilers	1	Handling, storage and protection	5	Solar thermal water heating	1
Building integration	2	Handover requirements	5	Stability	5
C		Heat pumps	1	System design	2
Certification	2	I		T	
Clean Air Act	3	Insulation of pipework	3	Testing and commissioning	5
Competency of installers	4	L		W	
D		Location	5	Weather resistance	5
Definitions	1	P		Wind turbines	1
Discharge	3	Pipes and insulation	4		
E		Products	4		
Electrical requirements	2	R			
F		Refrigerant pipework	3		
Fixing/s	4, 5				
Flashings	4				
Fuel storage	3				