RIAS-regs

Learning Modules

Version 8.0 February 2023

RIAS
The Royal Incorporation
of Architects in Scotland

CONTENTS

Updates to Version 1.1

The changes to this Scheme Guide since version 1.1 of this Guide include:

- Revised approval procedure to allow members to demonstrate competency before being assigned an Approved Body;
- The requirement for all Approved Certifiers of Design (Section 6 – Energy) Domestic to demonstrate competency in preparing DER/TER SAP2012 compliance calculations using the Standard Assessment Procedures (SAP) before being approved;
- The withdrawal of the option to undertake a DER/TER SAP2012 compliance calculation using a manual spread sheet;
- Revised references to legislation;
- Revised references to the Building Standards Division of the Scottish Government (BSD) in place of the Scottish Building Standards Agency (SBSA); and
- Withdrawal of the Scheme calculator.

Updates to Version 2.0

A thorough review of the Modules, with enhanced and substantially more guidance throughout. References to the Standards and Regulations within Modules 2-6 have been moved to section headings.

Updates to Version 3.0 & 3.1

References to October 2010 revisions to the Building Standards and SAP2012 added and reference to on-line tests updated.

Updates to Version 4.0

This is particularly important in conversions where all the Standards in Section 5 are listed in Schedule 6 to Regulation 12 as Standards that must be complied with whereas Standards 6.2 – 6.6 are only to be complied with as far as is "*reasonably practical*".

Updates to Version 5.0

Updated with reference to the 2017 Technical Standards (Domestic) and with the additions of the Non-domestic Building Standards, the Domestic and Non-domestic Building Services Compliance Guides for Scotland.

Within these Learning Modules reference to each Section, Standard and Clause of the Building Standards may be followed by a reference to Domestic or Non-domestic as appropriate. Where there is no reference the point being made is of relevance to both.

Updates to Version 6.0

Minor updates regarding Energy Performance Certificates (EPCs) following the closure of the RIAS-regs Approved Organisation Scheme.

Updates to Version 7.0

General revisions as part of the reapplication process to provide the Schemes.

Updates to Version 8.0

Revised to take account of the changes to Section 6 – Energy of the Technical Standards, which come into force on 1st February 2023.

Introduction

The RIAS-regs Scheme approves Certifiers of Design (Section 6 – Energy) – Domestic and Non-domestic and is a joint initiative by RIAS Services Limited (on behalf of the RIAS) and Home Energy and Data Services Limited in accordance with the requirements of:

- *The Building (Scotland) Act 2003*
- *The Building (Scotland) Regulations 2004*
- *The Building (Scotland) Amendment Regulations 2006 and subsequent amendments*

Details of the Membership Criteria are published on the Scheme website www.RIAS-regs.co.uk

This Guidance is intended to take those who have applied to become Approved Certifiers of Design (Section 6 – Energy) Domestic and/or Non-domestic through a series of learning modules and online tests. This guide is not a substitute to reading the Technical Handbooks, nor the Domestic and Non-domestic Building Services Compliance Guides for Scotland published by the Building Standards Division of the Scottish Government and the documents cited therein.

The tests are designed to test applicants' competency in understanding and applying the Standards and guidance from the Technical Handbooks and Compliance Guides to the design for the energy performance of domestic and/or non-domestic buildings and encompasses alteration, extension, conversion and new build.

The online tests are designed to demonstrate that Approved Certifiers of Design have a firm understanding of their role and responsibilities as well as the methods of demonstrating compliance with building regulations, for alterations, extensions, conversions, and new dwellings and/or non-domestic buildings including the National Calculation Methodologies – Standard Assessment Procedure (SAP) and/or Simplified Building Energy Model (SBEM).

Central to certifying the design of new dwellings is the need to complete a DER/TER and/or DDER/TDER compliance calculations using SAP10, which provides a detailed assessment of a dwelling's energy performance. Similarly demonstrating compliance of the design of new non-domestic buildings is achieved by completing a BER/TER and/or BDER/TDER calculation using SBEM Version 6, or in the case of certain advanced designs by the use of specialist Dynamic Simulation Models (DSM).

The ability to undertake a DER/TER and DDER/TDER SAP compliance calculation is integral to being able to certify the design of new build dwellings. This requires to be demonstrated through the practical SAP test which is provided by the Scheme.

The ability to undertake a BER/TER and BDER/TDER SBEM calculation is integral to being able to certify the design of new non-domestic buildings. This requires candidates to complete a recognised course in the use of iSBEM or approved software. For those who have not previously completed such a course an on-line course in the use of iSBEM is provided by the University of Strathclyde: https://onlineshop.strath.ac.uk/product-catalogue/engineering-faculty/mechanical-aerospace-engineering/courses/riascibse-certifier-of-design-training

Where an advanced design relies on the use of Dynamic Simulation Model (DSM) the candidate must provide evidence that they have completed a recognised course in the use of the particular approved software they wish to use. Details of Approved software can be found at: www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/techbooks/sectsixprg

It is assumed that all applicants are familiar with all the relevant documents available from the above sources and have a good working knowledge of the building regulation process and Standards within Scotland.

Information about RIAS may be found at www.rias.org.uk and about the scheme at www.RIAS-regs.co.uk

Even with the successful completion of the online tests and practical SAP or SBEM calculation tests, it is a fundamental requirement that an Approved Certifier of Design acts within his or her competency at all times.

Persons who are Approved Certifies of Design (Section 6 – Energy) Domestic and/or Non-domestic under the *Building (Scotland) Act 2003* will appear on the Certification Register which is maintained by the Building Standards Division of the Scottish Government (BSD) on behalf of the Scottish Ministers at www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards

Glossary of Terms and Abbreviations

Act	*Building (Scotland) Act 2003*
Approved Body	A firm, public body, or other organisation that is a member of the Scheme.
Approved Certifier	An Approved Certifier of Design (Section 6 – Energy) Domestic and/or Non-domestic
BSD	Building Standards Division of the Scottish Government (formerly SBSA – Scottish Building Standards Agency)
Building Regulations	*Building (Scotland) Regulations 2004* as amended
CABE	Chartered Institute of Building Engineers
Certificate	A Certificate of Design (Section 6 – Domestic or Non-domestic) issued by an Approved Certifier
Certification Coordinator	A person employed by an Approved Body who countersigns Certificates of Design
CIAT	Chartered Institute of Architectural Technologists
DSM	Dynamic Simulation Modelling
CIBSE	Chartered Institute of Building Services Engineers
EPBD	*The European Buildings Directive 2002/91/EC (2003) and recast 2010/31/EU (2012)*
EPC	Energy Performance Certificate
Firm	A company, partnership, LLP, or sole practitioner
LABSS	Local Authority Building Standards Scotland
Procedure Regulations	*Building (Procedures) (Scotland) Regulations 2004*
Register	The Certification Register of Approved Certifiers of Design, Approved Bodies and Schemes maintained by the Building Standards Division of the Scottish Government (BSD), formerly the Scottish Building Standards Agency (SBSA) certification register. The Certification Register is available for viewing at www.scotland.gov.uk/bsd.
RIAS	The Royal Incorporation of Architects in Scotland
RIAS Services Limited	Is a wholly owned trading subsidiary of RIAS; a company limited by guarantee the operation of RIAS Services Limited is wholly under the control of the RIAS
SAP	Government Standard Assessment Procedure for energy rating of dwellings

SBEM	Government Simplified Building Energy Model for energy rating of non-domestic buildings
Sole Practitioner	An Approved Certifier who is also solely responsible for the management of the Approved Body to which they belong and which does not employ any other Approved Certifiers
Verifier	Body appointed by Scottish Ministers to oversee the administration of the building warrant process - currently the 32 Scottish Local Authorities

See also the Glossary in the *BSD (May 2012) Scottish Building Standards Certification Handbook – Edition 3, which apply to schemes approved under Section 7(2) of the Building (Scotland) Act 2003.*

Definitions

Approved Body	A firm, public body, or other organisation that employs at least one Approved Certifier of Design, operates systems to check compliance with *Building (Scotland) Regulations 2004 and subsequent amendments*, holds appropriate insurances and provides access for Approved Certifiers of Design to up-to-date regulations, codes, guidance, and training. Bodies approved by a Scheme Provider cannot certify compliance with the building regulations - a registered Certification Coordinator must countersign Certificates of Design issued by an Approved Certifier of Design.
Approved Certifier of Design	An individual with the appropriate understanding of their role, the qualifications and the experience required to certify that specified aspects of design comply with the *Building (Scotland) Regulations 2004* and subsequent amendments. Approved Certifiers of Design may be approved by a Scheme Provider under Section 7(2) of the Act or by the Scottish Ministers under Section 7(1). They may only issue Certificates of Design that are counter-signed by an Approved Certification Coordinator on behalf of an Approved Body. They must keep a record of all the Certificates of Design that they issue.
Certificates of Design	A building owner/developer may use a Certificate of Design to support an application for building warrant. A Certificate of Design certifies that the design described in the building warrant application complies with one or more of the functional Standards listed in schedule 5 to regulation 9 of the *Building (Scotland) Regulations 2004* and subsequent amendments. The Certificate is only valid under the Act when issued by an Approved Certifier of Design. Each Certificate of Design issued by a Section 7(2) Approved Certifier of Design must be counter-signed by the Certification Coordinator of an Approved Body that belongs to the same Scheme.
Certification Coordinator	An individual registered as responsible for signing Certificates of Design on behalf of an Approved Body. The Certification Coordinator acts as the contact point for the Approved Body and is responsible for maintaining the system of checking, insurance, policies, access to documents, training, and handling complaints for that Approved Body.
Scheme Provider	An organisation that operates one or more Schemes to certify compliance with the *Building (Scotland) Regulations 2004* and subsequent amendments for specified aspects of a project. The BSD criteria for approval of Scheme Providers include evidence of status, expertise in relevant aspects of design or construction, capacity to operate schemes, financial probity, and appropriate disciplinary procedures.
Verifier	Verifiers are appointed to verify that work complies with Building (Scotland) Regulations 2004, and subsequent amendments, both in terms of design and construction. Scottish Ministers have appointed the 32 Local Authorities in Scotland as Verifiers. The work of verification will usually be undertaken by their Building Standards Departments. Verifiers undertake “necessary checks” before verifying applications for building warrants and must make “reasonable enquiry” to assess whether completion certificates should be accepted when the works are complete. They must accept Certificates of Design by registered Approved Certifiers of Design or construction as conclusive of the matters certified. Verifiers do not scrutinise certified matters and are only expected to check that, for Section 7(2) approvals, the Approved Certifier of Design and the Approved Body were appropriately registered on the date the Certificate was signed.

Legislation and BSD Guidance

Copies of statutory documents can be downloaded from the Office of Public Sector Information: www.opsi.gov.uk/

Building (Scotland) Acts
The Building (Scotland) Act 2003
The Building (Scotland) Act 2003 (Commencement No. 1, Transitional Provisions and Savings) Order 2004
The Building (Scotland) Act 2003 (Exemptions for Defence and National Security) Order 2009
The Building (Scotland) Act 2003 (Commencement No. 2, and Transitional Provisions) Order 2009
The Buildings (Recovery of Expenses) (Scotland) Act 2014
The Building (Scotland) Act 2003 (Charging Orders) Regulations 2014
Building (Scotland) Regulations
The Building (Scotland) Regulations 2004
The Building Standards Advisory Committee (Scotland) Regulations 2004
The Building (Scotland) Amendment Regulations 2006
The Building (Scotland) Amendment Regulations 2007
The Building (Scotland) Amendment Regulations 2008
The Building (Scotland) Amendment Regulations 2009
The Building (Scotland) Amendment Regulations 2010
The Building (Scotland) Amendment Regulations 2011
The Building (Scotland) Amendment Regulations 2012 (SSI 2012/209)
The Building (Miscellaneous Amendment) (Scotland) Regulations 2013
The Building (Scotland) Amendment Regulations 2014
The Building (Scotland) Amendment Regulations 2015
The Building (Scotland) Amendment Regulations 2016
The Building (Miscellaneous Amendment) (Scotland) Regulations 2017
The Building (Miscellaneous Amendment) (Scotland) Amendment Regulations 2017
The Building (Scotland) Amendment Regulations 2019
The Building (Scotland) Amendment Regulations 2020
The Building (Scotland) Amendment (Amendment) Regulations 2022
Building (Scotland) Procedural
The Building (Procedures)(Scotland) Regulations 2004
The Building (Procedures)(Scotland) Amendment Regulations 2007
The Building (Procedures)(Scotland) Amendment Regulations 2009
The Building (Scotland) Amendment Regulations 2011
The Building (Miscellaneous Amendment) (Scotland) Regulations 2013
The Building (Miscellaneous Amendments) (Scotland) Regulations 2017
The Building (Miscellaneous Amendments) (Scotland) Amendment Regulations 2017

Building (Fees)
The Building (Fees) (Scotland) Regulations 2004
The Building (Fees) (Scotland) Amendment Regulations 2007
The Building (Fees) (Scotland) Amendment Regulations 2008
The Building (Miscellaneous Amendments) (Scotland) Regulations 2017
Building (Forms)
The Building (Forms) (Scotland) Regulations 2005
The Building (Forms) (Scotland) Amendment Regulations 2006
The Building (Forms) (Scotland) Amendment Regulations 2007
The Building (Scotland) Amendment Regulations 2011
The Building (Miscellaneous Amendment) (Scotland) Regulations 2013
The Building (Miscellaneous Amendments) (Scotland) Regulations 2017
The Building (Miscellaneous Amendments) (Scotland) Amendment Regulations 2017
Energy Performance Regulations
The Energy Performance of Buildings (Scotland) Amendments Regulations 2008
The Energy Performance of Buildings (Scotland) Regulations 2008
The Energy Performance of Buildings (Scotland) Amendment (No2) Regulations 2012 (SSI 2012/208)
The Energy Performance of Buildings (Scotland) Amendment Regulations 2012 (SSI 2012/190)
The Energy Performance of Buildings (Scotland) Amendment (No3) Regulations 2012
The Energy Performance of Buildings (Scotland) Amendment Regulations 2013
The Energy Performance of Buildings (Scotland) Amendment (No 386) Regulations 2015
The Energy Performance of Buildings (Scotland) Amendment Regulations 2016
The Assessment of Energy Performance of Non-domestic Buildings (Scotland) Regulations 2016
The Energy Performance of Buildings (Scotland) Amendment Regulations 2017
BSD Guidance
BSD (2007) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2008) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2009) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2010) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2011) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2013) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2015) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2017) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2019) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (2021) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (June 2022) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
BSD (December 2022) Scottish Building Standards Technical Handbook: Domestic & Non-domestic
Domestic Building Services Compliance Guide for Scotland 2015
Non-domestic Building Services Compliance Guide for Scotland 2015

Non-domestic Building Services Compliance Guide for Scotland 2018
Domestic Building Services Compliance Guide for Scotland 2022
Non-domestic Building Services Compliance Guide for Scotland 2022
Procedural Handbook 3rd Edition 2017 Version 1.5
Procedural Handbook 3rd Edition 2019 Version 1.6
Procedural Guidance on Certification including Information to be submitted with a Building Warrant Application. Version 2.0, 2017
Certification Handbook for schemes approved under Section 7(2) and direct appointments under Section 7(1) of the Building (Scotland) Act 2003. May 2012 Edition 3
Accredited Construction Details (Scotland) (2007)
Accredited Construction Details (Scotland) (2010) • *Introduction and Principles (Updated June 2011)* • *Part 1 - Full Fill masonry Construction Details* • *Part 2 - Partial Fill masonry Construction Details* • *Part 3 - Timber Frame Construction Details* • *Part 4 - Metal Frame Construction Details* • *Part 5 - Additional Common Junction Details*
Accredited Construction Details (Scotland) 2015 Parts 1-5
Method for Testing in Support of Section 5 - Noise and Section 6 – Energy 2011
Guide to the Condensing Boiler Installation Assessment Procedure 2010
National Calculation Methodology (NCM) Modelling Guide for Non-domestic Buildings in Scotland 2010
National Calculation Methodology (NCM) Modelling Guide for Non-domestic Buildings in Scotland 2015
National Calculation Methodology (NCM) Modelling Guide for Non-domestic Buildings in Scotland 2022
6.A - Tables of U-values and thermal conductivity
6.B - Worked examples of U-value calculations using the combined method
6.C - U-values of ground floors and basements
Safe and sustainable installation of low carbon equipment: • *Introduction to the Guides 2010, updated 2012* • *Air Source Heat Pumps (ASHP) 2010* • *Ground Source Heat Pumps and Water Source Heat Pumps (GSHPand WSHP) 2010* • *Solar Thermal Systems or Solar Hot Water 2020* • *Biomass Installations 2012* • *Photovoltaics 2012*
New guidance in support of Section 3: Environment 2015
Other Guidance
SAP2005 - The Government's Standard Assessment Procedure for Energy Rating of Dwellings v9.83
SAP2012 - The Government's Standard Assessment Procedure for Energy Rating of Dwellings v9.90
SAP2012 Conventions v5.0 12 September 2013
SAP2012 - The Government's Standard Assessment Procedure for Energy Rating of Dwellings v9.92
SAP2012 Conventions v6.0 20 October 2015
SAP2012 Conventions v7.0 31 August 2017
SAP2012 Conventions v8.1 01 September 2018
SAP2012 Conventions v8.2 01 March 2021
SAP2012 Conventions v9.0 01 December 2022
SAP10.2 - The Government's Standard Assessment Procedure for Energy Rating of Dwellings v10.2 01 February 2023

BRE Report 262 'Thermal insulation, avoiding risks' 2002 edition Reprinted 2006
BRE Digest 398 Continuous Mechanical Ventilation in Dwellings: Design, Installation and Operation Sept 1994
BR 443 (2006 Edition) U-values, 'conventions for U-Value calculations'
BR 443 (2019 Update) U-values, 'conventions for U-Value calculations'
BRE 497 – Conventions for calculating linear thermal transmittance and temperature factors
BRE IP 1/06 – Assessing the effects of thermal bridging at junctions and around openings
HVCA - Guide to Ductwork Leakage Testing DW/143
CE29 Domestic Heating by Oil: Energy Savings Trust (EST)
CE30 Domestic Heating by Gas: Energy Savings Trust (EST)
CE47 Domestic Heating by Solid Fuel: Energy Savings Trust (EST)
CE54 Domestic Heating Sizing Method (2010 Edition)
CE83 Energy-efficient refurbishment of existing housing: Energy Savings Trust (EST)

The following documents relate to the calculation of U-values for specific products and materials and the Approved Certifier of Design should make reasonable efforts to ensure that when provided U-values by third parties they have adhered to the advice contained within these Standards.

BS 12939:2001	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Thick products of high and medium thermal resistance
BS 1566-1:2002	Copper indirect cylinders for domestic purposes - Open vented copper cylinders – Requirements and test methods
BS 1566-2:1984	Copper indirect cylinders for domestic purposes - Specification for single feed indirect cylinders
BS 3198:1981	Specification for copper hot water storage combination units for domestic purposes
BS 5422:2009	Method for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40ºC to +700ºC
BS 5864:2004	Installation and maintenance of gas-fired ducted air heaters of rated input not exceeding 70 kW net (2nd and 3rd family gases)
BS 8206: Part 2: 2008	Lighting for buildings. Code of practice for daylighting
PAS 67: 2008	Laboratory tests to determine the heating and electrical performance of heat-led micro-cogeneration packages primarily intended for heating dwellings
BS EN 483: 2000+A4:2007	Gas-fire central heating boilers. Type C boilers of nominal heat output not exceeding 70 kW
BS EN 525: 2009	Non-domestic direct gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW
BS EN 621: 2009	Non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW, without a fan to assist transportation of combustion air and/or combustion products
BS EN 778: 2009	Domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 70 kW, without a fan to assist transportation of combustion air and/or combustion products
BS EN 1020: 2009	Non-domestic forced convection gas-fired air heaters for space heating not exceeding a net heat input of 300 kW incorporating a fan to assist transportation of combustion air or combustion products
BS EN 1319: 1999	Domestic gas-fired forced convection air heaters for space heating, with a fan-assisted burners not exceeding a net heat output of 70kW

BS EN 1507: 2006	Ventilation for buildings. Sheet metal air ducts with rectangular section. Requirements for strength and leakage
BS EN 1566-1: 2000	Plastics piping systems for soil and waste discharge (low and high temperature) within building structure - chlorinated poly (vinyl chloride) (PVC-C) specifications for pipes, fittings and the system
BS EN 5864: 2004	Installation and maintenance of gas-fired ducted air heaters of rated output not exceeding 70 kW (second and third family gases). Specification.
BS EN ISO 6946: 2007	Building components and building elements. Thermal resistance and thermal transmittance - Calculation method
BS EN ISO 8990: 1996	Thermal insulation. Determination of steady-state thermal transmission properties. Calibrated and guarded hot box
BS EN ISO 10077-1: 2006	Thermal performance of windows, doors and shutters Calculation of thermal transmittance - Simplified method
BS EN ISO 10077-2: 2003	Thermal performance of windows, doors and shutters. Calculation of thermal transmittance - Numerical method for frames
BS EN ISO 10211: 2007	Thermal bridges in building construction. Heat flows and surface temperatures. Detailed calculations
BS EN 12237: 2003	Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts
BS EN 12524: 2000	Building materials and products. Hygrothermal properties – Tabulated design values
BS EN 12567-2: 2005	Thermal performance of windows and doors - determination of thermal transmittance by hot box method roof windows and other projecting windows
BS EN 12664:2001	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Dry and moist products of medium and low thermal resistance
BS EN 12667:2001	Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance
BS EN 12939: 2001	Thermal performance of building materials and products - determination of thermal resistance by means of guarded hot plate and heat flow meter methods - thick products of high and medium thermal resistance - includes corr14030 Dec 02

BS EN 12975-1:2006	Thermal performance of building materials and products - determination of thermal resistance by means of guarded hot plate and heat flow meter methods - thick products of high and medium thermal resistance - includes corr14030 Dec 02
BS EN 12975-1: 2006	Thermal solar systems and components - solar collectors general requirements - includes amd16423 May 06
BS EN ISO 13370: 2007	Thermal performance of buildings. Heat transfer via the ground. Calculation methods
BS EN ISO 13789: 2007	Thermal performance of buildings. Transmission heat loss co-efficient - Calculation method
BS EN 13829: 2001	Thermal performance of buildings - determination of air permeability of buildings - fan pressurisation method'
BS EN 13842: 2004	Oil fired forced convection air heaters. Stationary and transportable for space heating
BS EN 14511: 2007	Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling
BS EN 15232: 2007	Energy performance of buildings. Impact of building automation, controls and building management
BS EN 15450: 2007	Heating systems in buildings. Design of heat pump heating systems
BS EN ISO 15927-3: 2009	Hygrothermal performance of buildings. Calculation 3 and presentation of climatic data. Calculation of a driving rain index for vertical surfaces from hourly wind and rain data
BS EN 60335-2-35	Household and similar electrical appliances. Safety. Particular requirements for instantaneous water heaters

The Standards are available from:

BSI
389 Chiswick High Road
London
W4 4AL

Telephone: 0345 080 9000

Fax: 020 8996 7001

www.bsigroup.com/en-GB/standards/

www.bsi-global.com/

Foreword

The Building (Scotland) Act 2003 provides the opportunity for design professionals in Scotland to be able to certify that a design meets one or more functional Standards within the regulations. This comes with responsibility and a requirement to achieve a level of expertise in the areas certified that removes the need for scrutiny of such works by a Verifier at design stage.

Certification of Design is only possible for those designers who have gained membership of a Certification Scheme approved by Scottish Ministers. Certifiers of Design must certify compliance relative to the version of the Technical Standards in force at the time that the building warrant application is registered by the Verifier. These Learning Modules are updated in line with the most recent revisions to Section 6 – Energy of the Technical Standards, which come into force on 1st February 2023.

RIAS Services Limited (a wholly owned subsidiary of the Royal Incorporation of Architects in Scotland) was approved as a Scheme Provider by the Scottish Government on the 21st August 2007 for the Certification of Design (Section 6 – Energy) Domestic and on 28th November 2013 for the Certification of Design (Section 6 – Energy) Non-domestic. The Schemes are designed as membership services available to ARB registered architects, CIAT Chartered and Technologist Members (MCIAT and TCIAT), CIBSE Corporate Members and Low Carbon Consultants and other suitable Construction Professionals.

Section 6 (Domestic)

In the case of dwellings, Approved Certifiers of Design (Section 6 – Energy) Domestic will be able to certify that a design complies with all the functional Standards within Section 6 - Energy of the Building Standards, insofar as they relate to the design of the proposals and that also, in achieving this compliance, the design does not compromise compliance with any other functional Standards or the building regulations in general. Standards that must be considered in the design of a domestic building for building warrant are:

- 6.1 Energy Demand and Carbon Dioxide Emissions
- 6.2 Building Insulation Envelope
- 6.3 Heating System
- 6.4 Insulation of Pipes, Ducts and Vessels
- 6.5 Artificial and Display Lighting
- 6.6 Mechanical Ventilation and Air Conditioning

and the Domestic Building Services Compliance Guide for Scotland.

Standards that are relevant to the construction phase of works are:

- 6.7 Commissioning Building Services
- 6.8 Written Information
- 6.9 Energy Performance Certificates.

In certifying the design of Section 6 - Energy it is necessary to consider and address the implications that the design may have on these three Standards for example the:

- location of equipment to enable commissioning and maintenance
- type and extent of the written information required by the building user
- location of an Energy Performance Certificate (EPC) and the requirement for an EPC to be provided in accordance with the Energy Performance of Buildings (Scotland) Regulations, including who can produce an EPC

Such relevant information should be identified within the design to assist in both the construction phase and to allow the Verifier to undertake their Reasonable Inquiry duties on site.

Section 6 (Non-domestic)

In the case of non-domestic buildings, Approved Certifiers of Design (Section 6 – Energy) Non-domestic will be able to certify that a design complies with all the functional Standards within Section 6 - Energy, insofar as they relate to the design of proposals and that also, in achieving this compliance, the design does not compromise compliance with any other functional Standards or the building regulations in general.

Standards that must be considered in the design of a non-domestic building for building warrant are:

- 6.1 Energy Demand and Carbon Dioxide Emissions
- 6.2 Building Insulation Envelope
- 6.3 Heating System
- 6.4 Insulation of Pipes, Ducts and Vessels
- 6.5 Artificial and Display Lighting
- 6.6 Mechanical Ventilation and Air Conditioning
- 6.10 Metering

and the Non-domestic Building Services Compliance Guide for Scotland.

Standards that are relevant to the construction phase of works are:

- 6.7 Commissioning Building Services
- 6.8 Written Information
- 6.9 Energy Performance Certificates
- 6.10 Metering.

In certifying the design of Section 6 - Energy however it is necessary to consider and address the implications that the design may have on these four Standards for example the:

- location of equipment to enable commissioning and maintenance
- type and extent of the written information required by the building user
- location of an Energy Performance Certificate (EPC) and the requirement for an EPC to be provided in accordance with the Energy Performance of Buildings (Scotland) Regulations, including who can produce an EPC

Such relevant information should be identified within the design to assist in both the construction phase and to allow the Verifier to undertake their Reasonable Inquiry duties on site.

Authority

Under Section 7(2) of the Building (Scotland) Act 2003, the Scottish Ministers may approve schemes in accordance with persons (whether as individuals or bodies corporate or unincorporated) who are presently members of those schemes that are entitled to exercise, for the purposes of this Act, the function of an Approved Certifier of Design and/or construction.

To fulfil their role properly, Approved Certifiers of Design must have adequate support from their Approved Body and communication with other members of the design team.

In order to provide Certification of Design services, a firm (company, partnership, or sole practitioner), public body, or other organisation must meet the conditions required to become a Member of the Scheme as an Approved Body. The Scheme Provider will assess all applications for membership from individuals and firms.

All Certificates of Design must be signed by both an Approved Certifier of Design and the Certification Coordinator of the Approved Body employing the Approved Certifier of Design; this may be the same individual.

The RIAS in conjunction with Home Energy and Data Services Limited will be responsible for operating the Scheme which is subject to audit by the Building Standards Division of the Scottish Government (BSD).

The Scheme Provider must commission audits of the certification practice of Approved Bodies and their Approved Certifiers of Design. Put in place procedures for registering Approved Bodies and Certification Coordinators and develop and implement disciplinary and appeal procedures in line with the requirements of the Scheme as approved by Scottish Ministers.

The *Scottish Building Standards Certification Handbook* and *Procedural Handbook* describe the provisions of the *Act* and of *the Building (Procedures) (Scotland) Regulations 2004*.

Auditing

RIAS-regs is regularly audited by the Building Standards Division of the Scottish Government.

Continuous Improvement

RIAS-regs is committed to a process of continuous improvement in terms of both the documentation provided and the procedures adopted. To achieve this, it is important that the Scheme engages with those who have subscribed.

RIAS-regs has aimed from day one to be a Members Service and as such relies on feedback. There are six areas where we welcome specific feedback and suggestions:

Documentation

If you feel any area of the Scheme documentation can be improved and have suggestions with regard to the procedural guidance, checklists etc please let the Technical Advisor to the Scheme know. All suggestions will be reviewed and responded to.

Learning Materials

The Learning Materials are intended as an additional resource to help subscribers through the on-line tests. It is particularly important to ensure that they keep pace with the Building Standards. Please let the Technical Advisor to the Scheme know if you spot what might be an error or inconsistency.

On-Line Tests

RIAS-regs reviews the pass rate of each of the on-line test questions on a regular basis in order to ensure that each is written fairly, accurately and unambiguously. By being able to see all of the test results we can check the overall response to each particular question against the average.

We welcome feedback from those taking the tests. If you come across a question which you think is poorly worded or you suspect you have answered correctly and the systems says "*no*" please let the Technical Advisor to the Scheme know.

SAP Test

The Practical SAP Test is undertaken by all Approved Certifiers of Design (Section 6 - Energy) Domestic and is marked by Home Energy and Data Services Limited on behalf of the Scheme. As with the on-line tests this has the advantage that many different attempts at the Practical SAP Tests are available to compare and this helps to ensure that the test is correct. The Technical Advisor to the Scheme welcomes feedback regarding the information provided in the test.

SBEM Test

All Approved Certifiers of Design (Section 6 - Energy) Non-domestic must demonstrate the ability to complete SBEM or DSM calculations. This can be achieved either through completing the SBEM course (and the iSBEM Practical Test) provided by Strathclyde University, in collaboration with the Scheme:

https://onlineshop.strath.ac.uk/product-catalogue/engineering-faculty/mechanical-aerospace-engineering/courses/riascibse-certifier-of-design-training or by providing evidence that an equivalent course and test has been completed using iSBEM or an up to date version of an approved non-domestic software programme. Details of which can be found at: http://www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/techbooks/sectsixprg

Procedural and Regulatory Questions

RIAS-regs works closely with both the Building Standards Division of the Scottish Government (BSD) and Local Authority Building Standards Scotland (LABSS) in order to support Certification. It is not uncommon for Approved Certifiers of Design to have specific questions with regard to the Certification Procedures and Building Standards. Where these are relevant to the wider issues of Certification and demonstrating compliance RIAS-regs is happy to address these directly with BSD and LABSS, and where appropriate, issue or amend Scheme Guidance.

Introduction to the Learning Modules

Members of the Scheme must demonstrate competence prior to being placed on the Certification Register maintained by BSD, accession to which enables the members to perform the functions of an Approved Certifier of Design (Section 6 – Energy) – Domestic and/or Non-Domestic.

All Members of the Scheme must demonstrate that they have professional indemnity insurance in place to cover their work as an Approved Certifier of Design.

Registration as an Approved Certifier of Design will depend on successfully completing the six Domestic and/or Non-domestic online training modules designed to ensure that members can demonstrate knowledge of:

- **Module 1: Roles, Duties and Procedures**
  (shared by both Domestic and Non-domestic Schemes)
- **Module 2: Design Limits**
- **Module 3: Alterations, Extensions and Conversions**
- **Module 4A: Calculation Methods for New Dwellings**
- **Module 4B: Calculation Methods for New Non-domestic Buildings**
- **Module 5: Other Section 6 Issues**
- **Module 6: Other Section 1 - 5 and 7 Issues**

The answers in the on-line tests for Modules 1-6 are all based on the regulations in that came into force on 1st February 2023

In total the competency tests can be recorded as worth 10 -12 hours of CPD. Once the online tests are successfully completed, the candidates for Section 6 – Energy (Domestic) will be asked to undertake the practical SAP Test. The candidates for Section 6 – Energy (Non-domestic) will be asked to provide proof that they have completed a recognised course in one or more of: iSBEM, a proprietary program such as Design Builder or a DSM program such as IES.

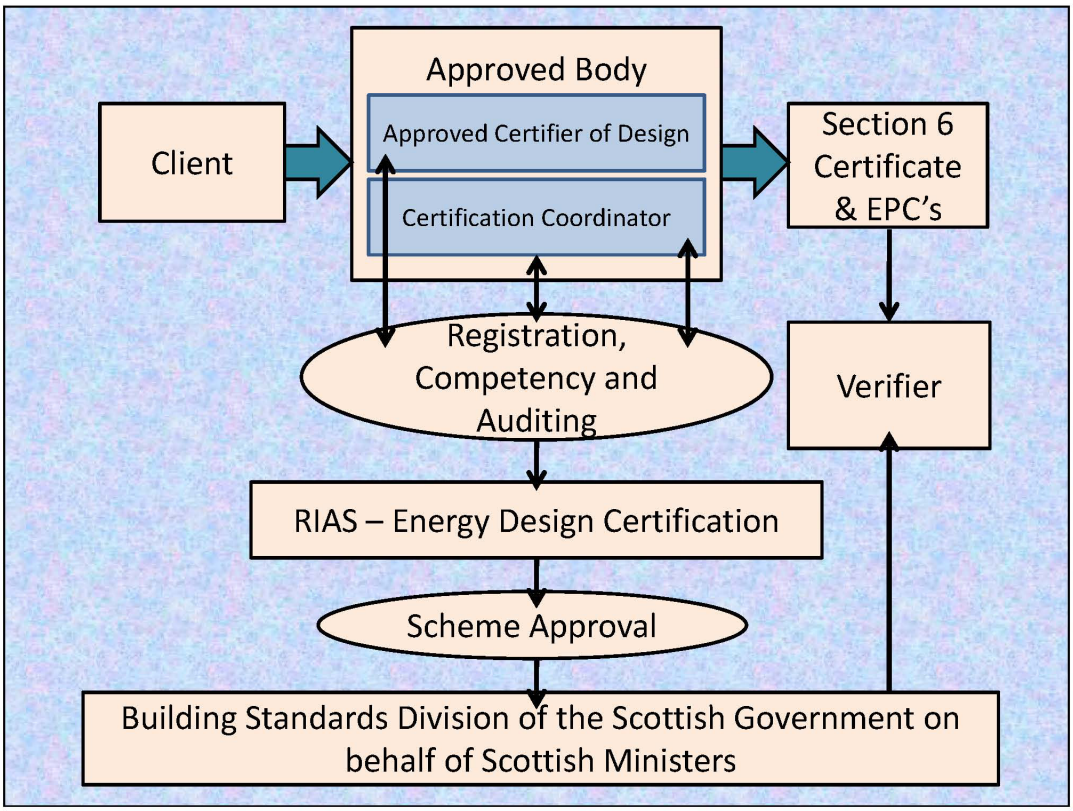
The information contained within the Learning Modules and Scheme Guidance is subject to addition and clarification by the issue of Technical Bulletins as and when considered necessary by RIAS-regs.

Module 1

Roles, Duties and Procedures

1. MODULE 1

Roles, Duties and Procedures



1.1 The Certification Process

Each Certificate is produced by an Approved Certifier of Design working for or within an Approved Body. The role and duties of the Approved Body are undertaken by a Certification Coordinator. For small practices and sole practitioners this may in fact be the same person, but it is important to draw a distinction between two roles and duties.

Each Certificate is accompanied by a Certification Checklist, (see module section 1.6 below) this both records the design information available and where the design meets specific standards and clauses in the Building Standards. The Checklist should not be copied to the Verifier but does form a key communication tool with the applicant / agent and wider design team. In the event of dispute, it is the Certification Checklist, together with the certification information stored within RIAS-regs's IT system that would be relied upon to assess the design and certification processes.

1.1.1 The Certificate

A Certificate of Design (Section 6 – Energy) applies to the whole of the "*domestic*" or "*non-domestic*" work described in the application for a building warrant. Albeit this may be subject to the provision of future stages and/or Schedule 1 / Form Q (see below). The Certificate(s) must be signed by an Approved Certifier of Design and countersigned by the Certification Coordinator of the Approved Body.

Where a project includes both domestic and non-domestic elements, such as new build flats above a shop, each certificate relates to all of those parts of the building in either domestic or non-domestic occupation. For the new building to be fully certified two certificates are required. Where a domestic and non-domestic certificate is provided these can be provided by different Approved Certifiers of Design and different Approved Bodies, as long as, both are working within the relevant designations. Each Certificate of Design (Section 6 - Energy) Domestic must however cover all of the domestic design and the

Certificate of Design (Section 6 - Energy) Non-domestic certificate must cover all of the non-domestic design. The boundary between these two areas of design being the external space, party walls, floor etc which physically separate the two building types. Where only one Certificate of Design is provided for a mixed use project, the Verifier will still be required to check compliance of the uncertified elements.

Certificates of Design relate to design work which has been completed and complies with the Regulations. It must be made clear that this certification is not a statement that the design ***will*** comply with the Regulations after it is finished. The process of producing a Certificate of Design remains the same whether the design has been prepared by an Approved Certifier of Design or has been prepared by others whether within the Approved Body or as members of a larger design team.

An Approved Certifier of Design will issue a Certificate of Design, generated using the Scheme's on-line system, to the applicant or agent for a building warrant or amendment to warrant, who then submits the application to the Verifier, noting the number of the Certificate of Design in an annex to the application.

Where a Certificate of Design is not immediately available, the applicant or agent may wish to confirm, within the building warrant application process that a Certificate of Design will be provided prior to the issuing of the building warrant. To do this the applicant or agent will provide the registration numbers of the Approved Certifier of Design and their Approved Body. This allows the building warrant application fee to be reduced in line with current guidance and means that the Verifier instead of raising questions in their report, with regard to Section 6, they simply note, in their warrant report, that a Certificate of Design and accompanying information is required, prior to the issuing of the building warrant.

It is contrary to the intension of both the Regulations and the Scheme for an Approved Certifier of Design to sign a Certificate of Design when design work has not been completed and assessed, unless otherwise covered by a future Stage or Schedule 1 (see below).

1.1.2 Continuity of Approved Certifier of Design and/or Approved Body

Where a project is covered by a staged building warrant (permitting details of future stages to be provided later via an amendment to warrant) ideally, the same Approved Certifier of Design should be used at each stage. However, it is recognised that a change of an Approved Certifier of Design may be unavoidable on the part of an Approved Body.

If, for any reason either an Approved Certifier of Design and/or an Approved Body responsible for certifying the initial stages of the application is no longer available replacements can be appointed. A replacement Approved Certifier of Design cannot sign subsequent staged or amendment Certificate(s) of Design unless and until they have satisfied themselves of the adequacy of all of the preceding stages of the application and the mutual compatibility of those various stages. Similarly, a Certification Coordinator of a replacement Approved Body cannot sign a Certificate of Design unless it has been included within the Approved Bodies Certification Logbook. To ensure compliance and documentation of this the replacement Approved Certifier of Design must create and issue certificates to replace those issued previously.

In any circumstances relating to staged building warrants where it is necessary for the Approved Certifier of Design or Approved Body to change during the course of the building warrant application process, the applicant for the building warrant should write to notify the Verifier of the change, detailing how it has been dealt with and confirming that both the Approved Certifier of Design and Approved Body are accepting responsibility for compliance with the regulations for all stages of the application. A new Approved Body should secure an appropriate appointment from the client covering the provision of certification services for the entire application.

All applications for staged building warrants shall clearly define the extent of the works covered in detail by the application and accompanying Certificate of Design. The Certificate of Design applies to the whole of the work described in the application for building warrant covered by (Section 6 – Energy) – Domestic or Non-domestic but confirms that only the design for the current stage is complete.

1.1.3 On Completion

On the completion of a building the "*relevant person*" (as defined by the Building (Scotland) Act 2003) must submit to the Verifier a completion certificate confirming that the building complies with both the Building (Scotland) Regulations and the building warrant, as granted. The Approved Certifier of Design should ensure that the relevant person has been supplied with any information regarding the design which the Certifier regards as necessary to enable a completion certificate to be signed.

To allow the Verifier to determine whether to accept a certificate of completion, the Verifier must be presented with all documentation necessary to support reasonable enquiry during the construction phase of the project (drawings, specifications, DER/TER and/or DDER/TDER or BER/TER and/or BDER/TDER compliance calculations etc). The same level of information is required to document the design regardless of whether a Certificate of Design is submitted.

1.2 Role and Duties of an Approved Body

The Approved Body is the primary contracting organisation which provides certification services either in isolation or in combination with other design services. These might range from energy design advice as part of a wider design team, to providing full architectural or engineering services up to including acting as agent for the purposes of the building warrant application.

An Approved Certifier of Design, engaged by an Approved Body, is given a personal registration number. If subsequently they are employed by a firm not on the Register, the individual cannot act as an Approved Certifier of Design until that firm is registered as an Approved Body. An Approved Certifier of Design can work for more than 1 Approved Body and will have a unique reference number for each instance.

It is important that the Approved Body makes the agent/applicant for the building warrant and any wider design team members aware of the distinction between certification of Section 6 – Energy and any design advice being provided. The duties of the Approved Body include:

1 Maintaining Professional Indemnity Insurance to cover certification services

2 Employing a Certification Coordinator

3 Employing at least one Approved Certifier of Design

4 Providing each Approved Certifier of Design with adequate resources

5 Complying with relevant legislation

6 Submitting to audit and providing audit returns when requested by RIAS-regs

7 When an Approved Certifier of Design leaves the Approved Body, the Approved Body must appoint a replacement Approved Certifier of Design in order to complete the certification of projects in hand or cooperate with any other Approved Body that may be appointed

8 In the event that the Approved Body has neither a Certification Coordinator nor an Approved Certifier of Design they will be temporarily suspended by the Scheme until replacements are appointed

9 It is the responsibility of the Approved Body to maintain a certification logbook as outlined in the Schemes Quality Assurance Guidance for Approved Bodies and Approved Body Logbook File Structure (both downloadable from the Scheme website) these include copies of:
- PII Certificates
- Scheme Membership Certificates
- QA procedures
- Complaints Procedures
- Complaints log

- CPD records for all Approved Certifiers of Design
- Any RIAS-regs correspondence
- Previous Audits and details of any remedial action

In addition, the Logbook must contain copies of all those certificates and certificate checklists issued together with either documentary evidence of the designs as certified (preferably) or within the certification checklist reference to the location of these designs. This information must be retained for a minimum of 25 years and should include copies of:

- Section 6 Design Certificates
- Certification checklists
- Schedule 1 / Form Q
- Design drawings
- All relevant calculations
- All relevant specifications
- U-value calculations and Ψ-values (where applicable)
- Compensatory heat loss calculations (where applicable)
- DER/TER or BER/TER compliance calculations (where applicable)
- DDER/TDER or BDER/TDER compliance calculations (where applicable)
- Manufacturers trade literature used to demonstrate specified performance
- Specialist contractors design information.

RIAS-regs now provides an on-line secure folder, hosted by sync.com, which facilitates each Approved Certifier of Design the ability to save all of their certification activity and the form required by the Scheme. This will also make the future auditing of Approved Certifiers of Design more streamlined.

1.3 Roles and Duties of an Approved Certifier of Design

An Approved Certifier of Design is an individual with the appropriate understanding of their role, the qualifications and the experience required to certify that specified aspects of design comply with the *Building (Scotland) Regulations 2004* and subsequent amendments. Approved Certifiers of Design may be approved by a Scheme Provider under Section 7(2) of the Act or by the Scottish Ministers under Section 7(1)

1 The Approved Certifier of Design must be satisfied that their knowledge and experience enable them to discharge the responsibility of certifying a particular design is compliant.

2 By applying to join the Scheme, an Approved Certifier of Design is deemed to have declared that they will not irresponsibly issue Certificates of Design.

3 The adoption of the appropriate level of examination of designs, undertaken and recorded in a methodical manner, before they are certified is a fundamental part of the Scheme.

4 Notwithstanding the applicant or agent's responsibility to assemble and coordinate the building warrant application the Certifier must ensure that works certified under a Certificate of Design in respect of (Section 6 -Energy) – Domestic and/or Non-domestic is prepared with an understanding of how other works may affect matters certified and also that certified works do not adversely affect compliance of other works with the requirements of the functional Standards within Sections 1-5 & 7 of the Scottish Building Standards Technical Handbooks and with the Building (Scotland) Regulations 2004, as amended.

Where it becomes reasonably apparent to an Approved Certifier of Design that the energy design may compromise compliance elsewhere, they must raise these concerns with other members of the design team and the applicant/agent for the building warrant application.

Specific guidance on the role of the Approved Certifier of Design is detailed in Section 1.9 of the Scottish Building Standards Procedural Handbook, which can be downloaded at:

https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2019/09/procedural-handbook/documents/scottish-building-standards-procedural-handbook-third-edition-v1-6/scottish-building-standards-procedural-handbook-third-edition-v1-6/govscot%3Adocument/scottish-building-standards-procedural-handbook-third-edition-v1-6.pdf

The guidance includes the requirement that *"*Approved certifiers must have due regard to compliance with all relevant building standards requirements, which may impact on the work undertaken, not just those of immediate relevance to the particular scheme*".*

This does not infer that in Certifying (Section 6 – Energy) – Domestic and/or Non-domestic an approved Certifier of Design or an Approved Body takes responsibility for any design aspects beyond Section 6 (unless contracted to do so as part of a wider commission) but that these issues are considered within the Certification Checklist.

As such the Certification Checklist forms an important communication tool between the Approved Certifier of Design and the wider design team.

5 Section 6 – Energy, must be read in conjunction with all relevant sections and guidance offered in The Building (Scotland) Regulations 2004, as amended. But in particular:

i. Section 1 – Structure, Approved Certifiers of Design for Section 1 – Structure and Section 6 – Energy, should pay particular attention to the location of thermal insulation in floors, walls and roofs. Especially, when preparing engineering drawings and specifying connections and fixing of structural elements. In other words, Engineering and architectural drawings and specifications should reflect consistency
ii. Section 2 – Fire, Approved Certifiers of Design should be aware of the fire resistance of certain thermal insulation products, as well as the position of heating systems, boilers etc in relation to combustible materials
iii. Section 3 – Environment, this has a close affiliation with energy efficiency. In particular:
    a) the provision of natural or mechanical ventilation of buildings
    b) natural lighting and thermal comfort
    c) reducing air changes can increase the risk of condensation
    d) controlling condensation and humidity in moisture producing wet areas
    e) controlling interstitial condensation in roofs and other fabric elements
    f) location of services, which may breach vapour control layers or cause thermal bridges. For example, a constructional hearth and associated chimney breast and flue/chimney may be constructed of different materials from that of the main exposed wall type
    g) heating systems and the supply and removal of combustion air
    h) the supply of cooling air for combustion appliances
    i) assessment of overheating
iv. Section 4 - Safety, where issues to consider include positioning of controls for fixed building services to allow safe and easy use, and avoiding positioning radiators etc which obstruct circulation spaces needed for access
v. Section 5 – Noise, careful attention to detailing and specification is essential to ensure acoustic separation is not compromised by the thermal performance of walls and floors etc.
vi. Section 7 – Sustainability, where there are improved energy and/or $CO_{2(e)}$ emissions are to be evidenced

6 Schedule 2 to the Act prohibits an Approved Certifier of Design who is also a Verifier from certifying any matter for which they act as a Verifier.

7 The Scheme requires that individual members who perform the function of Approved Certifiers of Design (Section 6 – Energy) – Domestic and/or Non-domestic:

I. Exercise appropriate skill, care, diligence and judgement in undertaking the Certification of Design (Section 6 – Energy) – Domestic and/or Non-domestic with respect to the *Building (Scotland) Regulations 2004*, as amended, in their role as a part of the design team with a

continuous involvement in the design process. They must have due regard for compliance with the full range of relevant Building Standard requirements, not just those of immediate relevance to the particular aspect

II. Adhere to the Code of Conduct of the Scheme (which can be found on the Scheme website) as well as Codes of Conduct of any other Professional Body of which an Approved Certifier of Design may also be a Member

III. Do not represent themselves as having expertise or experience that they do not possess

IV. Undertake only those tasks for which they have appropriate expertise and experience

V. Do not certify work designed by others without carrying out necessary checks to satisfy themselves of the adequacy of the design and its compatibility within the whole design

VI. Acknowledge that for some projects they may lack appropriate experience to enable them to act as the Approved Certifier of Design, for example where the demonstration of compliance departs from those methodologies detailed in the Building Standards and relies on meeting the Performance Standards enshrined in the primary legislation

VII. Disclose to RIAS-regs if they have been convicted of an offence by a Court or have been subject to an adverse finding of any kind by any Tribunal, Court or other Authority

8 Approved Certifiers of Design must provide evidence of their Continuing Professional Development (CPD) when requested by the Scheme.

9 If fees for membership of an Approved Certifier of Design are not paid prior to the annual subscription date, the Approved Certifier of Design will be suspended. If fees remain unpaid for more than 12 months a full re-application is required prior to re-instatement.

10 Any member who wishes to resign their membership must inform RIAS-regs who will notify BSD by the end of the next working day. Membership may be terminated or other disciplinary action taken at any time following properly conducted appeals and disciplinary procedures.

11 Approved Certifiers of Design shall have an obligation to serve on the Scheme Review Panel if called. Remuneration and expenses will be given at a rate set by the Panel.

1.4 Role and Duties of a Certification Coordinator

The Certification Coordinator is an individual employed by an Approved Body and registered as responsible for countersigning Certificates of Design on behalf of that Approved Body. The Certification Coordinator acts as the contact point for the Approved Body and is responsible for discharging the duties assigned to the Approved Body principally the Certification Coordinator is responsible for:

1. ensuring that the conditions under which the Approved Body was approved are fulfilled and maintained. Any change in the Certification Coordinator must be reported to RIAS-regs
2. implementing the Approved Bodies QA and complaints procedures
3. maintaining access to documents and resources required by the Approved Certifier of Design(s)

The Certification Coordinator of an Approved Body is not permitted to countersign a Certificate of Design during any period when the body does not employ at least one Approved Certifier of Design and must inform RIAS-regs of any such periods.

An alternative Certification Coordinator of an Approved Body may be appointed to cover periods of absence when the Certification Coordinator is unavailable to countersign certificates. Periods of absence in this instance being annual leave and sickness etc. It is not intended that an alternative Certification Coordinator should work in tandem with the Certification Coordinator but as a stand in for periods of continuous absence to allow the process of certification to continue.

1.5 Role and Duties of a Verifier

Verifiers are appointed to verify that work complies with *Building (Scotland) Regulations 2004*, (as amended at the time that the building warrant application was registered) in terms of design and construction.

The Scottish Ministers have appointed the 32 local authorities in Scotland as Verifiers. The work of verification will usually be undertaken by their Building Standards Departments.

On receipt of a building warrant application, the Verifier will check that sufficient information has been provided to allow the application to be processed and assessed against the building regulations. The responsibility to provide that information lies with the applicant or their agent. The Verifier will then:

1 assess an application for a building warrant and will issue a building warrant where it is determined that proposals comply with the Building (Scotland) Regulations. They will also make reasonable enquiry to determine that works carried out comply both with the issued building warrant and the Building (Scotland) Regulations when considering whether to accept a submitted completion certificate. The purpose of the building standards system is to protect the public interest not the interest of the applicant, the design team or Approved Certifiers of Design.

The granting of a building warrant and the acceptance of a completion certificate should not be construed as conclusive evidence of compliance with the Building Standards, nor does it imply any transfer of liability from the designers of the works

2 Verifiers must accept Certificates of Design issued by an Approved Certifier of Design as conclusive of the matters certified. They retain a duty to check that any certificates submitted accords with the scope and extent of the building warrant application to which they relate. A Verifier can rely on the fact that an Approved Certifier of Design must take account of those requirements of Sections 1-5 & 7 of the Scottish Building Standards which may influence whether the energy design of the building satisfies The Building (Scotland) Regulations 2004 as amended.

3 Verifiers do not scrutinise certified matters and are only expected to check that, for Section 7(2) approvals, the Approved Certifier of Design and Approved Body were appropriately registered on the date the Certificate of Design was signed.

4 Verifier's are required to make reasonable enquiry before accepting a completion certificate. To enable this, verifiers will require copies of designs, specifications and calculations prepared by an Approved Certifier of Design in order to check the works on completion. The same level of information is required to document the design regardless of whether a Certificate of Design is submitted or not.

5 Schedule 2 to the Act prohibits a Verifier from certifying any matter for which they act as Verifier. Any Approved Certifier of Design that is employed by a Verifier, or an Approved Body that is also a Verifier, is not entitled to issue any Certificates of Design that relate to an application it is verifying.

1.6 Certification Checklists

The Approved Certifier of Design must use and store a Certificate Checklist with every Certificate of Design issued for scrutiny as part of any audit. Certificate checklists serve to record the information available to describe the certified design and the steps taken by the Approved Certifier of Design at each stage throughout the certification process. An Approved Certifier of Design must ensure that they:

- are working within their competency
- record if they are providing wider design services and whether they are the applicant or agent for the building warrant application
- have all the information required to certify the design and that they have liaised with all the other members of the design team to ensure that the design, as a whole, complies with Section 6 - Energy (Domestic and/or Non-domestic) and that the energy design will have no adverse effect on any other aspect of compliance under The Building (Scotland) Regulations
- have assessed the design through calculation where necessary

- where they are reliant on external information, have obtained such information from reliable sources and checked it for accuracy as far as is practicable. Where there is any doubt over accuracy, such information should not be used, and the matter referred to the party for whom certification activities are being undertaken
- where reliance has been placed on an assumption of performance, this has been documented and subsequently checked for compliance and
- have ensured that the process has been accurately and methodically recorded.

Templates and a completed example of the Certification Checklist(s) are provided on the Scheme website, it consists of two parts covering information and compliance. The purpose of the first part is to record all the information that was made available, which describes the design that has been certified as compliant.

If the Approved Body / Approved Certifier of Design is also providing wider design service and/or is the applicant or agent for the building warrant application and the Approved Body is retaining copies of drawings and specifications alike, within their archives, there is no need for a separate hard copy to be maintained. However, it is essential that the location of the information is known and can be made available for scrutiny as part of an audit. Where information is held electronically then then the information pertinent to certification should be duplicated in the electronic certification logbook, hosted by sync.com – see the Schemes Quality Assurance Guidance for Approved Bodies, available on the Scheme website.

Where reliance has been placed on information provided by others, this should be kept with the certification / project file for the purposes of allowing access as part of any audit.

The second part of the Certificate Checklist covers compliance and provides space for the Approved Certifier of Design to note against each of the Sections, Standards and Clauses, those steps they have taken to assess compliance. Where a Standard or Clause is not relevant to the particular design it can be left blank. The 2015 version of the Certification Checklist extended this to the Domestic and Non-domestic Building Services Compliance Guides for Scotland and these have been further extended to include the latest revisions included in Section 6 - Energy of the Technical Standards

1.7 Online Checklist

In the process of creating a Section 6 – Energy Certificate of Design, the Approved Certifier of Design will be taken through a series of online checks. These checks are designed to encompass the role of the Approved Certifier of Design and the type of project being certified. This checklist is retained electronically within the system for audit purposes.

1.8 Schedule 1 / Form Q

It is recognised that when assessing compliance of a project there may be areas where the final performance of an element of the certified design will not be known, usually because the detailed design is under the control of a specialist designer or manufacturer. Where the performance can be defined as reliant on a single element, such as a minimum boiler performance or area weighted average U-value for windows, it is sufficient for this to be noted within the drawing notes in order that the Verifier can check the actual performance based on the installed boiler or windows etc.

Where the performance of an element of fabric or services are dependent on a combination of materials or components such as may be the case with Low or Zero Carbon Generating Technologies (LZCGT), heating systems and specific building elements a Schedule 1 should be used.

In generating a Certificate of Design, the Approved Certifier of Design must tick the "*Schedule 1*" box and complete a Schedule 1 by hand - a blank copy is downloadable from the Scheme website. A copy of the Schedule 1 must accompany the Certificate of Design and a copy kept with the certification logbook. The Schedule 1 details the performance specification that has been used to demonstrate compliance and this is further recorded within the Certification Checklist.

For subsequent stages or amendments, where the parent Certificate includes a Schedule 1, an amended Schedule 1 may continue to be relevant – as those elements not previously submitted are removed, a

Schedule 1 may be introduced for a subsequent stage, where one was not originally submitted, however an element cannot be added to a Schedule 1, which was previously designed and submitted at an earlier stage.

As soon as the actual performance of the item(s) included on the Schedule 1 is known and demonstrated to meet or exceed the performance specification used, the Approved Certifier of Design must issue a Form Q to the Verifier confirming compliance. Blank Form Q's are provided by the relevant local authority and copies of these should be filed with the relevant Certificate of Design.

Approved Certifiers of Design must be aware that, in order to prepare a specific EPC on completion of a new building(s) the actual performance of any systems or elements covered by a Schedule 1 will be required.

In addition, particular care is needed when a Schedule 1 is required for an element which has an impact both on energy performance and on one or more of the other Sections of the Building Standards.

In such an instance it may be sufficient for the Approved Certifier of Design to assume a minimum performance in line with that which can normally be expected. The Approved Certifier of Design must advise the Applicant or Agent and other members of the design team, particularly other Approved Certifiers of Design, of the assumptions that they have made.

When an Approved Certifier of Design has issued a Schedule 1, they must confirm via a Form Q that they have considered the actual performance of an element previously covered by the Schedule 1. When Approved Certifiers of Design from different schemes have used Schedule 1, a separate Form Q must be submitted for each scheme.

1.9 The Auditing Process

It is a requirement of providing the Scheme that every Approved Body and Approved Certifier of Design is audited at least once in every three years. RIAS-regs has developed and adjusted the auditing procedures over time to make the process as simple and straightforward for both Approved Certifiers of Design and the Scheme as possible.

Audits take place on a regular cycle and in response to complaints, disciplinary issues or as a result of a previous audit outcome. The Scheme has now established electronic Certification Logbooks, for each Approved Certifier of Design, hosted by sync.com. Approved Certifiers of Design are expected to upload details of their CPD, PII and Certificates of Design as they are renewed or created.

RIAS-regs Schemes audit procedures are published on-line at www.RIAS-regs.co.uk

Module 2

Design Limits

2. MODULE 2

Design Limits

2.1 Introduction

Section 6 - Energy of the Technical Standards and the Building Services Compliance Guides focus on the reduction of energy demand and $CO_{2(e)}$ emissions arising from new buildings and new building work. This is done by identifying both design (and backstop) values for the building insulation envelope and for the fixed building services - space and hot water heating, cooling, ventilation, lighting, and ancillary systems, such as pumps etc., together with correct commissioning of systems, the provision of operating instructions, Energy Performance Certificates (EPCs) and the metering of buildings in separate occupancies.

Different compliance methodologies are available to the designer depending on whether the nature of the work comprises alteration, extension, conversion, or new build. Each type of work has a set of design values which, if adhered to, will demonstrate compliance. Each methodology also allows a greater or lesser degree of trade-off between different design values, as long as the backstop values are also met. Where a building warrant application covers more than one type of work, then each type must comply relative to the methodologies that apply.

In dealing with a new building, a conversion, or alterations to an existing building, working within or improving upon the design values is essential, if the functional Standards within Section 6 - Energy and the Building Services Compliance Guides are to be complied with and energy efficient construction is to be delivered. It must be remembered that the Building Standards and the Building Services Compliance Guides describe the minimum performance thresholds that are required to ensure compliance and, in many cases, building owners will wish their buildings to perform beyond this for social, economic, and environmental reasons.

For new buildings a Target $CO_{2(e)}$ Emissions Rate (TER) is set under Standard 6.1 and is measured in $kgCO_{2(e)}/m^2$ per year. In a significant change, from 1st February 2023, Standard 6.1 also sets a Target Delivered Energy Rating (TDER). The introduction of the TDER reflects the fact that electricity generation in Scotland is now responsible for nearly net zero $CO_{2(e)}$ emissions. Electricity consumption of a heat pump is therefore considered to have net zero direct $CO_{2(e)}$ emission (NZDE) at the point of use.

From 1st February 2023 all new dwellings, where the main fuel is fossil based or from a heat network, will have to meet both the TER and TDER, whereas those where the main fuel is electricity will only have to meet the TDER.

Approved Certifiers of Design must be able to assert that the minimum threshold of the TER (where applicable) and the TDER have been met by undertaking DER/TER and DDER/TDER compliance calculations using SAP10.2 for new dwellings or BER/TER and BDER/TDER compliance calculations using SBEM for new non-domestic buildings. These calculation methodologies are discussed in detail within Module 4.

The previous option to use a simplified method of demonstrating compliance for new dwellings, by meeting or exceeding, each of the specification requirements used to set the TER has now been removed.

2.2 Compliance

Standard 6.1 requires a holistic assessment of the carbon and energy performance of new buildings and is dealt with in Module 4. Standards 6.2 to 6.8 apply to all building work (new buildings as well as alterations, extensions, and conversions) and they address the performance of building fabric and fixed building services, including guidance on energy efficient building services and effective controls. Standard 6.9 requiring the provision of an EPC on completion applies to all new buildings and 6.10 requiring the provision of metering to all occupancies within new buildings applies only to non-domestic buildings.

Over time the revisions to the Building Standards aim at raising the threshold of compliant performance in line with Scottish Government commitments. The thresholds for new buildings are impacted in three ways through revisions to the National Calculation Methodologies of SAP and SBEM:

- Refinements to the methodologies to improve accuracy
- new criteria are added such as assessing energy
- and most significantly the TER / TDER design values are updated to raise the bar for compliance.

Section 6 - Energy identifies minimum expected design values under the following headings:

- fabric performance such as heat loss, air infiltration and thermal bridging
- heating and hot water systems
- insulation of pipes, ducts and vessels
- mechanical ventilation and air conditioning
- artificial lighting.

2.3 Fabric Performance

Standard 6.2 (building insulation envelope) recommends maximum area-weighted U-values for building elements of the insulation envelope as well as maximum values within each element type, which should not be exceeded. The Building Standards also provide references to other documents in particular the following which cover in more detail U-values, thermal bridging and the performance of the Accredited Details (Scotland) Guidance 2010:

1. *BR 443: 2019 Conventions for U-Value calculations*

   This publication provides guidance on the use of the calculation method by:
   - indicating the method or methods of calculation that are appropriate for different construction elements;
   - providing additional information about using the methods;

2. *BRE Report 262 (2006): Thermal insulation, avoiding risks'*

   This report was first published in 1989, with substantial revisions in 1994 and updated in 2002 and reprinted in 2006. It highlights four "*principal technical risks*":
   - Inadequate design
   - Inappropriate construction techniques
   - Inadequate protection from external environment
   - Disregard for through-life performance

   It deals with both general principles such as minimising thermal bridging, air infiltration and interstitial condensation and some specifics, such as sizing cables where they pass through insulation and sizing insulation to water pipes.

   The Report is equally applicable to new dwellings, alterations, extensions, and conversions. It is however only where compliance calculations are used where non-repeat linear thermal bridge calculations and air infiltration rates can be included by way of design values and (in the case of air infiltration) subsequently tested to demonstrate compliance prior to completion.

   The Report does not deal with the more recent development of breathing constructions.

3. Accredited Construction Details (Scotland) 2010 and 2015

   The Building Standard Division of the Scottish Government published revised construction details in 2010 for typical construction junctions in several common construction methodologies, such as timber frame and masonry construction systems. These were augmented with further published versions of these developed in the light of the 2015 revisions to the Building Standards and are available at:
   https://www.gov.scot/publications/building-standards-list-of-guidance/pages/key-supporting-technical-guidance/

   The guidance provides indicative ψ-values for junctions and guidance on limiting air infiltration. Ψ-values are used to accurately calculate the impact of non-repeat linear thermal bridges in compliance calculations. The values in the guidance are intended only to demonstrate the improvement in performance that can be achieved by careful detailing and subsequent calculation. They should only be used in a compliance calculation if the details, as shown, are replicated as part of the building warrant submission. Use of such details, however, does not absolve the applicant of liability for ensuring compliance with all sections of the Technical Standards.

Both SAP and SBEM make assumptions, with regard to, U-values and the impact of both thermal bridging and air-tightness. In completing DER/DDER or BER/BDER calculations, design values for U-values and detailed thermal bridging can be used along with a design value for air-tightness. In each case these values must be demonstrated either through calculation prior to the granting of a building warrant or through testing on completion.

In calculating the impact of thermal bridging, either the default ψ-values in Appendix K or calculated ψ-values must be used. The ψ-values associated with specific details from the Accredited Construction Details (Scotland) Guidance (ACD), may also be used, subject to the caveats above, however the requirement to improve building fabric values beyond those of 2015, renders these less applicable and in practice the use of these values is discouraged. ψ-values may be mixed and matched.

In addition, the Building Standards for non-domestic buildings cover "*Shell and Fit Out*" buildings where commercial units are built on a speculative basis for let or sale to an eventual occupier who may then fit out the building for one or other commercial activity.

2.3.1 Existing Buildings

Alterations, extensions, and conversions to existing buildings generally take an elemental approach to energy performance, based upon maximum U-values and the adoption of good practice with regard to thermal bridging and airtightness which together give a maximum allowable heat loss through fabric elements.

Individual elemental U-values of the same fabric element (i.e., walls) can be area weighted (subject to the backstop values) to allow one or more specific wall construction(s) to balance others maintaining an overall average compliant performance.

Clause 6.2.7 (Domestic) / 6.2.8 (Non-domestic) provide guidance in relation to the conversion of "*Historic, Listed and Traditional Buildings*". The definition of these lies in the Building Standards Division's Procedural Handbook and echoes that in Historic Environment Scotland's Guide to Practitioners No 6:

Historic building means a building of architectural or historic interest. A historic building does not have to be listed by Scottish Ministers or lie within a conservation area to be deemed to have special interest or significance;
Listed building means a historic building, which has been included in a statutory list because of its special architectural or historic interest; and
Traditional building means a building or part of a building, of a type constructed before or around 1919;
a. using construction techniques that were commonly in use before 1919; and
b. with permeable components, in a way that promotes dissipation of moisture from the building fabric.

Clause 6.2.8 (Domestic) also allows use of a SAP compliance calculation to be used to show that an existing dwelling plus a proposed extension meets the requirements of Standard 6.1 (Domestic) as if it was an entirely new dwelling. Such an approach is only likely to be viable for very new dwellings (where a full description of the dwelling construction and services is available) or perhaps ones which are undergoing a significant refurbishment at the same time as being extended.

Similarly Clause 6.2.9 (Non-domestic) allows use of a SBEM compliance calculation to be used to show that either the proposed extension in isolation, or the existing building as extended meets the requirements of Standard 6.1 (Non-domestic) as if it were an entirely new building.

Clauses 6.2.11 and 6.2.12 (Domestic) give guidance with regard to conservatories and stand-alone buildings associated with dwellings.

2.3.2 U-Value Calculations

In determining U-values, designers should be aware of the effect common construction issues can have on calculated U-values. To assist in this, awareness of the content of BR 443: 2019 is essential, which addresses such issues as:

- air gaps within the insulation
- mechanical fasteners penetrating an insulation layer
- precipitation on inverted roofs
- calculation of the average U-value of tapered roof insulation
- the effect of inclining glazing, glazing is generally tested in the vertical plan (including roof lights) inclining the glazed surface skywards increases heat loss and therefore BR 443: 2019 applies a correction factor based on the angle of tilt
- surface resistance
- mortar joints in masonry construction
- voided masonry units
- foam-faced blocks
- timber fraction for timber-framed walls
- timber fraction for other elements
- plasterboard wall lining airspace resistance
- corrections to thermal transmittance
- metal-faced roofing and wall cladding

- light steel-framed buildings.

The risk of interstitial condensation in any particular construction should also be assessed (see 2.3.5 below).

The Table 6.1 to Clause 6.1.2 (Domestic) details the attributes of the notional dwelling used to set the TER and TDER for new dwellings and this includes U-values for party walls between dwellings and with other heated buildings. Introduced to take account of heat loss through a cavity in a party wall due to air movement three different options can be used in DER and DDER calculations:

- solid party wall, U-value of 0.00 (this value is assumed for the setting of the TER and TDER)
- cavity wall, cavities barriers at perimeter to limit air movement, U-value of 0.20
- cavity wall, no cavity barriers, U-value of 0.50

The equivalent Non-domestic clause (6.1.4) allows heat loss through separating walls to adjoining heated spaces to be ignored in SBEM compliance calculations, however Clause 6.2.1 (Non-domestic) goes on to cite good practice.

2.3.3 Openings

In the case of windows, doors, and roof lights, the assessment should be based on the whole unit, for example, in the case of a window, the combined performance of the glazing and the frame. Trickle vents are not however included within any calculation. While the presence of trickle vents impacts upon heat transfer, controlled ventilation is regarded as a separate issue.

Window and door manufacturers typically quote U-values based on a standard overall window size, proportion and design tested in a hot box in line with ISO 12567 – Part 1 or 2. The actual U-value for a given window size, design and proportion will however vary with the overall frame factor and Approved Certifiers of Design should ensure that an area weighted average is used in determining compliance, particularly where openings are significantly different to the standard assumption.

No guidance is given for the minimum or maximum area for windows, doors, and roof flights in new dwellings as the methodology assesses the heat loss, taking account of the net loss of the building envelope overall and solar gains from windows. The compliance calculations however assumes that the total area of openings will be, in the case of the notional dwelling will be 25% of the floor area. In the case of the notional non-domestic building the assumptions are more complex, varying with the use class of each zone. In both methodologies, however, the wall area of the net wall area of the notional design is adjusted to ensure each notional and proposed calculation has the same overall envelop area.

For alterations to existing dwellings, where the area of openings within the existing envelope is being increased, the total area on completion should not exceed 25% of the total dwelling floor area, unless a compensatory heat loss calculation demonstrates that the increased area above that limit is balanced by an increased thermal performance elsewhere.

For extensions to existing dwellings, the area of openings should be limited to 25% of the floor area of the extension plus the area of any openings that have been built over, as a result of the work. The area of openings can, again, be varied by using the compensatory heat loss approach, where the overall heat loss of the extension is assessed by varying the U-value of the elements while achieving an overall heat loss equal to or less than an extension designed to meet the elemental U-values with the area of openings set at 25% of the floor area of the extension plus the area of any existing openings built over.

Large extensions to non-domestic buildings are required to be assessed as if they were independent new buildings following the requirements of Standard 6.1. The trigger point for this requirement is described in paragraph a.(ii) of the limitations to Standard 6.1.

For smaller extensions to non-domestic buildings, the maximum area of windows and roof lights in an extension is expressed as a percentage of the new external walls and new roof areas and depends on the use of the building. These can be also be varied using the compensatory heat loss method.

The Building Standards preserve the fact there are no limits on the area and no backstop U-value for display windows for retail premise in new buildings other than the practicalities cited in Clause 6.2.2 (Non-domestic), however they are included with SBEM compliance calculations, meaning that they must be compensated for elsewhere in the design.

2.3.4 Thermal Bridging

As *BRE Report 262 (2006): Thermal insulation, avoiding risks'* and the Accredited Construction Details (Scotland) 2015 note, particular attention must be given to the detailing of junctions between building elements and around openings in order to minimise the impact of thermal bridging and air infiltration.

Thermal bridging can be categorised into repeating linear thermal bridges and non-repeating linear thermal bridges.

Repeating thermal bridging occurs regularly within the planar elements themselves, for example - mortar joints in block walls, timber joists in floors and mullions in curtain walling and are included when calculating the U-values of such planar elements.

Non-repeating linear thermal bridging occurs where there is a junction between planes, for example at a floor and wall, or at reveals to openings where there is a transition or break in the continuity of adjacent constructions. These create additional heat paths which resulting in both additional heat loss and the potential for surface condensation.

For alterations, extensions and conversions of existing buildings, there is generally no requirement to quantify this heat loss but it should be minimised by following the guidance in *BRE Report 262 (2006): Thermal insulation, avoiding risks'* and the Approved Certifier of Design must reassure themselves that this has been achieved in the proposed construction details. The only exception to this is if SAP or SBEM are being used to assess compliance of extensions.

Heat loss through non-repeating linear thermal bridging in new dwellings, is expressed as a Y-value. The Y-value is calculated from the sum of the lengths of all the thermal bridges multiplied by their respective Ψ-value divided by the exposed building envelop. The notional dwelling assumes a Y-value of 0.05. The use of a default Y-value in DER/TER compliance calculations was removed in 2015, requiring the calculation of the overall heat loss as a result of non-repeating linear thermal bridging.

The term Y-value is not used in relation to new non-domestic buildings however the impact of non-repeating linear thermal bridging is still considered. SBEM incorporates the option to calculate the impact in detail. Where this option is not used the notional calculation assumes an Alpha-value (equivalent to the Y-value) of 0.10 and the proposed calculation assumes a value of 0.25. Where the option to calculate the impact is taken, the notional calculation assumes Ψ-values taken from Table 3 of the NCM Modelling Guide for Non-domestic Building 2022.

Individual Ψ-values are derived on a detail-by-detail basis from:

- Appendix K in SAP for domestic buildings, or Table 9 of the NCM Modelling Guide 2022 for non-domestic buildings, or
- calculations by a specialist based on the actual construction details, or
- where construction of a junction follows published and substantiated construction detail sets, input of Ψ-values of the relevant junction(s) can be taken from that document. This includes the Accredited Construction Details (Guidance) published by BSD, but this requires the source detailing to be replicated and/or referenced in the building warrant application and constructed on site.

Ψ-values can be mixed and matched, detail by detail within the overall Y-value calculation.

The use of the Accredited Construction Details (Scotland) Guidance 2015 places an added responsibility on the shoulders of an Approved Certifier of Design as they must be satisfied that the design details do meet the requirements of the guidance as published. A simple statement that "they do" on a building warrant application is insufficient unless highlighted within a Schedule 1, wherein the Approved Certifier of Design has a further opportunity to either check the details, or have specific Ψ-values calculated prior

to issuing a Form Q. The Verifier will then have an expectation of seeing either the Accredited Construction Details (Scotland) 2015 being used on site or seeing detailed Ψ-values calculations which match the alternative details being used.

2.3.5 Ventilation

Standard 3.14 requires minimum levels of ventilation to control internal surface condensation that could lead to the growth of mould, to provide combustion air for heating appliances and most importantly of all to replenish the oxygen and remove high levels of $CO_{2(e)}$ and other pollutants for occupants. The guidance in Standard 3.14 has been expanded to recognise the need for purge ventilation to address both raised temperatures and concentrations of pollutants. The requirement to minimise heat loss through building fabric, has increased the relative impact of ventilation on energy performance.

Historically assumptions have been made with regard to the contribution that air infiltration through the building fabric makes. Buildings are now being constructed to greater air-tightness standards (see Section 2.4 below), often twinned with domestic mechanical vent heat recovery (MVHR) systems or commercial heating, ventilation and air-conditioning (HVAC) systems. Approved Certifiers of Design must therefore be mindful of the potential impact on air quality and the increasing need to control surface and interstitial condensation.

Clause 3.14.2 (Domestic) recognises that ventilation is composed of supply air, extraction, and purge ventilation. Clause 6.2.5 (Domestic) now requires all new dwellings to be air tested on completion and Clause 3.14.2 (Domestic) provides guidance on the suitability of three ventilation strategies:

- continuously operating balanced supply and extract systems. Where heat recovery is included these are known as Mechanical Ventilation and Heat Recovery (MVHR) systems, which are suitable in all circumstances
- continuous extract systems which may or may not be centralised mechanical extract ventilation (Cmev) or decentralised mechanical extract ventilation (Dmev) and are suitable for use where air infiltration is ≥ $3m^3/m^2/yr$@50 Pascal
- natural ventilation and intermittent extract fans (Clause 3.14.4 (Domestic) allows for passive stack ventilation as an alternative to intermittent extract fans), which is suitable for use where air infiltration is ≥ $5m^3/m^2/yr$@50 Pascal

In the case of MVHR the installed system provides fresh supply air, in the case of extract only strategies, background ventilators provide the air supply. In all circumstances a minimum whole dwelling ventilation rate must be provided which meets an assessment of each apartment as well as the whole dwelling.

Clauses 3.14.4-6 (Domestic) provide further guidance on each strategy and Clause 3.14.3 (Domestic) provides guidance on purge ventilation.

In Non-domestic buildings the same principles apply however the Building Standards recognise that there is a much greater range of complexity encountered in non-domestic buildings, which in turn is reflected in the additional designation within the RIAS – Energy Design Certification that some buildings are classed as "*Advanced Buildings*" requiring specialist input at design stage. For the purposes of this module and the on-line questions only those non-domestic buildings which lie below the "*Advanced Building*" threshold are dealt with, the requirements for which are detailed in Section 3.14 (Non-domestic).

In particular Clause 3.14.2 (Non-domestic) refers to three further guidance documents where a building is designed to have air infiltration ≤$5m^3/m^2/yr$@50 Pascal:

- Section 3 of BS 5925: 1991 (1995), or
- CIBSE Guide A: 2015, Design data, section A4, Air infiltration and natural ventilation, or
- CIBSE AM10: Natural Ventilation in Non-Domestic Buildings (2005) Applications Manual AM10: 2005.

2.3.6 Condensation

Standard 3.15 of the Technical Handbooks addresses both surface and interstitial condensation.

The first of these can occur where there are areas of poorly insulated building fabric and a combination of low external temperatures, poor ventilation, high internal temperatures, and a source of water vapour. If surface moisture is present for prolonged periods it can lead to mould growth, poor indoor air quality and damage to the building fabric.

Modern construction methods have helped to reduce the impact of surface condensation by providing higher levels of thermal insulation and adequate ventilation. However, for those projects where existing buildings are altered or converted Approved Certifiers of Design should consider the impact of changing the use of rooms and spaces which could lead to an increase in surface moisture.

Interstitial condensation occurs when a dew point is reached within a construction layer. That is to say at the point part way through the external fabric of the building where the temperature is no longer sufficiently high to support water vapour and it condenses into liquid. The dew point moves within building fabric dependent on the relative internal and external temperatures and the overall relative humidity of the environment.

The presence of moisture within a building's fabric is potentially a major risk to the building itself and can lead to failure of the fabric requiring costly repairs to deal with wet or dry rot etc. Building materials have varying levels of hygroscopicity (their ability to absorb and release moisture) and vapour resistance (the ability to prevent water vapour migrating across them). Equally building materials can be more or less robust in the face of prolonged exposure to moisture.

A build-up of moisture in the proposed construction can be alleviated in a number of ways if:

- the construction layer is robust enough to withstand the build-up, or
- a ventilated cavity is provided which allows moisture to be safely dried from the surface of a construction layer, or
- a "*breathing*" strategy is adopted where the vapour permeability of the various layers is carefully controlled to allow moisture to migrate out from the building fabric

In order to ensure that such risks are minimised Approved Certifiers of Design should be mindful of the guidance in *BRE Report 262 (2006): Thermal insulation, avoiding risks'* and undertake or check interstitial condensation calculations undertaken in accordance with BS5250 based on the fabric design of the building to ensure that any exposure is within safe limits. This is of particular importance as increasing levels of thermal insulation increases the propensity for interstitial condensation.

2.3.7 Manufacturers Information

Care must be taken when referring to a manufacturer's declaration of the thermal properties of a product. According to BR 443: 2019 Conventions for U-Value calculations:

"Where products are covered by a harmonised European Standard (EN) or a European Technical Approval (ETA), product declarations should conform to the requirements of the EN or ETA.

In other cases, the declaration of thermal properties should correspond to minimum thermal performance - in other words the thermal resistance should be at least that declared, or the thermal conductivity or thermal transmittance should be not more than declared".

2.4 Air Infiltration

Air infiltration is the propensity for air to pass through the external building fabric when there is a deferential pressure between the interior and exterior. Such pressure differences result from wind conditions and the method of ventilation of a building and can pass in either direction.

Unintended air infiltration through the building fabric can have a significant impact on energy performance. As air is lost and replaced, the replacement air will reduce the internal ambient temperature unless heating is provided. With increasing moves to limit the energy lost through the building fabric, through improved levels of insulation, the energy associated with heating the ventilation air is now a significant part of the overall energy requirement of a building.

2.4.1 Existing Buildings

For conversion, alteration or extensions of existing buildings the relevant Clauses are 6.2.10 (Domestic) and 6.2.12 (Non-domestic), which refers to *BRE Report 262 (2006): Thermal insulation, avoiding risks'* deals with general principles as outlined above.

Where a SAP compliance calculation has been used to demonstrate the compliance of an existing dwelling + new extension, Clause 6.2.5 (Domestic) requires an air-tightness test of the dwelling + extension to be airtightness tested prior to completion.

If a SBEM compliance calculation is used to demonstrate the compliance of an existing non-domestic building + new extension or the new extension in isolation, then an air-tightness test must be carried out for the volume included in the compliance calculation prior to completion.

2.4.2 New Buildings

Air infiltration is considered as part of the compliance calculations as set out in Standard 6.1. The values used to set the TER are:

- $5m^3/m^2/hr$@50Pascals for new dwellings
- $4m^3/m^2/hr$@50Pascals for new non-domestic buildings

Clause 6.2.5 (Domestic) and, with two exceptions, Clause 6.2.6 (Non-domestic) requires all new buildings and large non-domestic extensions to be airtightness tested prior to completion. The exceptions are:

- modular building of less than 150 m^2 where no site work is needed other than connection of modules, provided test results for similar configuration of modules with the same connection details is available.
- new buildings where due to size or complexity, it is impractical to carry out full testing of the building, provided this has been demonstrated as part of the building warrant submission and evidence to support the declared infiltration rate is provided in the form of sectional testing.

Non-domestic "*Shell and Core*" buildings must be tested at both the completion of the initial "*Shell and Core*" and again on completion of any fit out.

Where air-tightness testing is required the test procedures and the competency of the testing organisation must be stated on the building warrant application along with the value that has been used in any compliance calculations.

It is important when certifying the design that the Approved Certifier of Design has a full understanding of the construction details proposed and must have confidence that an assumed air-tightness test performance can be achieved.

Approved Certifiers of Design need to be particularly mindful of the implications of an air-tightness test giving a different value on completion from that assumed at design stage. If the value is poorer, then the overall energy performance may fall short of compliance. If better, the level of trickle vents and the overall ventilation strategy may no longer be compliant.

2.5 Space Heating and Hot Water Systems - Domestic

Space and water heating systems are intrinsic to the provision of comfort and convenience in buildings. They bring with them a requirement to be installed in a manner that makes them safe to use and they should be as efficient as possible. Standards 6.3 & 6.4 (Domestic) were revised and shortened in the

2015 Building Standards and the guidance previously contained in these standards is now largely found in the Domestic Building Services Compliance Guide for Scotland. Approved Certifiers of Design (Section 6 - Energy) must familiarise themselves with the this compliance guide.

Standard 3.13 (Domestic) requires the provision of adequate space heating in dwellings. Standards 3.17-3.22 (Domestic) deal with the safe installation and operation of combustion appliances and Standards 3.23, 3.24 & 4.11 (Domestic) address fuel storage and Standard 4.9 (Domestic) the safe installation and operation of hot water systems.

The specification of heating and hot water services also has particular relevance to compliance with Section 1 (Structure) where they impose loads on a building and Section 2 (Fire) where they could be a source of fire.

The Domestic Building Services Compliance Guide for Scotland requires minimum efficiencies for heating systems for new and existing buildings however consideration should be given to the systems proposed beyond that of checking for compliance. The Building Standards deal with the thermal performance of the building fabric separately from that of the heating and hot water systems and whilst these are assessed more closely in a compliance calculation, this does not mean every heating and hot water system will be ideally suited to every construction strategy.

Particular care should be taken that heating systems are sized correctly for a dwelling. For example, a small well insulated flat with low thermal mass could severely overheat if the heating system was based on a large range cooker with integral hot water facility, where the need for a cooking appliance meant it was on permanently.

The Domestic Building Services Compliance Guide provides additional guidance covering minimum efficiencies and/or specification requirements for:

- Gas fired space and water heating
- Oil fired space and water heating
- Heat pumps
- Electric heating
- Solid fuel heating
- Heat networks
- Underfloor heating
- Vessel, pipework, and ductwork insulation
- Mechanical ventilation
- Space and comfort cooling
- Solar water heating
- Lighting
- Micro-combined heat and power
- Heating system circulators
- Building automation and controls
- Self-regulating devices
- On-site generation of electricity

Alongside setting minimum efficiencies for heating systems the Domestic and Non-domestic Building Services Compliance Guides also impose measures to minimise inefficiencies through avoidable heat losses, by requiring the insulation of vessels, pipes and ducts and the need for appropriate control systems.

The relative location of boiler, hot water store and sanitaryware appliances can also have a major impact on the overall efficiency of installed systems, due to long pipe runs, however well insulated.

Standards 6.7 (Domestic) includes minimum requirements to ensure that services are adequately commissioned.

Standard 6.8 (Domestic) requires that sufficient written instructions are provided to building owners and users. This includes the requirement for a *'Quick Start Guide'* for new dwellings, together with, the requirement to provide information to enable retrofitting of non-direct emissions heating solutions to be made available on completion of all projects.

Clause 6.8.2 details the contents of the *'Quick Start Guide'* and Clause 6.8.3 the information required to enable retrofitting.

2.5.1 Existing Dwellings

Where systems are installed into an existing dwelling they are required to meet the Building Standards. However, for many smaller systems they are exempted from a requirement for a building warrant under Schedule 3 to Regulation 5, paragraphs 6-8. In such an instance there is also no requirement for them to be covered by a Certificate of Design (Section 6 – Energy) Domestic

Where such systems are included within a building warrant application as part of a bigger project then the Approved Certifier of Design must check that they comply with Section 6 - Energy (Domestic) and the Domestic Building Services Compliance Guide and that in complying they do not compromise compliance with other sections of the Building Standards.

Where a heating or hot water system is replaced, or parts of the system replaced Clause 6.4.1 (Domestic) requires that these new elements must meet the relevent requirements of the Domestic Building Services Compliance Guide.

2.5.2 Conversions

In the case of a conversion, the requirements of Standard 6.3 (Domestic) should be met in so far as is reasonably practical and the overall efficiency of any installed systems should be no worse than any systems that existed pre-conversion.

Approved Certifiers of Design have a particular responsibility in determining what is reasonable. The regulations clearly aim to ensure that all new dwellings meet a minimum standard as set by a SAP compliance calculation however with a conversion there is no requirement to undertake a SAP compliance calculation.

The nature of buildings being converted, and the extent of the work required, varies enormously from the conversion of a derelict or semi-derelict farm steading, where perhaps not much more than 4 walls are standing, to a change of use of a fully usable non-domestic building with potentially no physical changes required.

Where existing space and hot water heating systems are largely retained in a conversion then the Approved Certifier of Design should consider what upgrades, such as the introduction of thermostatic radiator valves (TRVs), programmers and pipework insulation can be achieved. Any adjustments to the system, such as additional pipe runs to serve new kitchens and bathrooms etc must meet the relevant requirements of the Domestic Building Services Compliance Guide.

2.5.3 New Dwellings

The previous five Fuel Packages used to set the TER & TDER, have been reduced to two. These assume system efficiencies for the heating system, its controls and the hot water system depending on whether the main system is an electrically powered heat pump or not. In addition a new package has been added for those dwellings which are to be connected to a heat network, in which case the system efficiencies for that network are used.

Compliance calculations include an overall heating requirement, based on the dimensions and attributes of the building fabric and a hot water requirement based on the overall floor area of the dwelling.

In undertaking SAP compliance calculations the Approved Certifier of Design must ensure that the systems as described in the calculation are those documented in the design to be certified.

Where the design of the hot water system is not fully available, for example when the choice of boiler is to be left to a specialist installer, then sufficient information to demonstrate compliance with the Domestic Building Services Compliance Guide should be included within the design to cover:

- Efficiency
- Fuel
- Location

- Controls
- Instructions
- Commissioning, etc

Where the design of the system is in part dependant on factors that can only be assessed during construction, (for example ground conditions which will dictate the design and efficiency of a ground source heat pump) or where there is more than one system attribute, which interact with each other to give an overall performance then these should be covered by a Schedule 1 and the design assumptions used in a SAP compliance calculation recorded in the certification checklist.

2.5.4 Zoning in Dwellings

The Domestic Building Services Compliance Guide requires that all dwellings must have at least 2 heating zones with independent temperature control, unless very small. Where a dwelling has a floor area ≥ 150m^2 the heating zones must have independent time control as well and no one zone should exceed 150m^2 in floor area.

The Domestic Building Services Compliance Guide reinforces the need to minimise the use of the main or additional hot water heating systems if a solar hot water heating system is installed and is capable of supplying that demand. It also requires the users to be provided with information regarding the control and use of the system.

2.6 Space Heating and Hot Water Systems – Non-domestic

Standard 3.13 (Non-domestic) which requires the provision of adequate space heating in buildings does not apply to non-domestic buildings. This recognises that not all non-domestic buildings or every part of a non-domestic building requires heating for its intended purpose, for example a multi-storey car park. The requirement to provide heating to a non-domestic building relates to its intended use and is controlled by other legislation, such as the Health and Safety at Work Act 1974.

Notwithstanding where heating is not required, for most non-domestic buildings space and water heating systems are intrinsic to the provision of comfort and convenience. They bring with them a requirement to be installed in a manner that makes them safe to use and they should be as efficient as possible. Standards 6.3 & 6.4 (Non-domestic) were revised and shortened in the 2015 Building Standards and the guidance previously contained in these standards are now largely found in the Non-domestic Building Services Compliance Guide. Approved Certifiers of Design (Section 6 - Energy) Non-domestic must familiarise themselves with the Non-domestic Building Services Compliance Guide.

Standards 3.17-3.22 (Non-domestic) deal with the safe installation and operation of combustion appliances, Standards 3.23, 3.24 & 4.11 (Non-domestic) addresses fuel storage and Standard 4.9 (Non-domestic) the safe installation and operation of hot water systems.

The specification of heating and hot water services also has particular relevance to compliance with Section 1 (Structure) where they impose loads on a building and Section 2 (Fire) where they could be a source of fire.

The Non-domestic Building Services Compliance Guide offers guidance on minimum efficiencies for heating systems however consideration must be given to the systems proposed beyond that of checking for compliance. The Building Standards deals with the thermal performance of the building fabric separately from that of the heating and hot water systems and whilst these are assessed more closely in compliance calculations, this does not mean every heating and hot water system will be ideally suited to every construction strategy.

Care should be taken that heating systems are appropriate to the use of the building, are sized correctly, are adequately controlled and properly commissioned. For example, a well-insulated highly glazed shop with low thermal mass could severely overheat from solar gain if the heating system relies on under floor heating which has a slow response time relative to potential heat gains.

European Directive 2009/28/EC promotes the use of energy from renewable sources http://europa.eu/legislation_summaries/energy/renewable_energy/en0009_en.htm such as: biomass equipment, heat pumps and solar thermal systems, giving minimum efficiencies for each

The Non-domestic Building Services Compliance Guide provides additional guidance covering minimum efficiencies and/or specification requirements for:

- Gas, oil and biomass-boilers
- Heat pumps
- Gas and oil-fired warm air heaters
- Gas and oil-fired radiant heaters
- Combined heat & power
- Direct electric space heating
- Domestic hot water
- Comfort cooling
- Air distribution
- Pipework and ductwork insulation
- Lighting
- Heating and cooling system circulators and water pumps
- Building automation and controls
- Self-regulating devices
- On-site generation of electricity

Alongside setting minimum efficiencies for heating systems the Non-domestic Building Services Compliance Guide also impose measures to minimise inefficiencies through avoidable heat losses, by requiring the insulation of pipes and ducts and the need for appropriate control systems.

The relative location of boiler, hot water store and sanitary ware appliances can also have a major impact on the overall efficiency of the systems in use, due to long pipe runs, however well insulated.

Standards 6.7 (Non-domestic) includes minimum requirements to ensure that services are adequately commissioned.

Standard 6.8 (Non-doemstic) requires that sufficient written instructions are provided to building owners and users. This includes the requirement for a *'Logbook'* for non-domestic buildings, together with, the requirement to provide information to enable retrofitting of non-direct emissions heating solutions to be made available on completion of all projects.

Clause 6.8.2 (Non-domestic) details the contents of the *'Logbook'* and Clause 6.8.3 (Non-domestic) the information required to enable retrofitting.

Standard 6.10 (Non-domestic) requires heat and power meters to be installed unless heated by solid fuel or biomass. Where a building is divided into multiple occupancy and has a communal heating system, then both the main system and each occupancy should be metered.

2.6.1 Existing Non-Domestic Buildings

Where systems are installed into existing non-domestic buildings they are required to meet the Building Standards. However, some systems are exempted from a requirement for a building warrant under Schedule 3 to Regulation 5, paragraphs 6-8. If carried out in isolation. In such an instance there is also no requirement for them to be covered by a Certificate of Design (Section 6 – Energy) Non-domestic.

Where such systems are included within a building warrant application as part of a bigger project then the Approved Certifier of Design must check that they comply with Section 6 - Energy (Non-domestic) and the Non-domestic Building Services Compliance Guide and that in complying they do not compromise compliance with other sections of the Building Standards.

Where a heating or hot water system is replaced, or parts of the system are replaced Clause 6.3.2 and Clause 6.4.2 (Non-domestic) requires that these new elements must meet the relevant requirements of the Non-domestic Building Services Compliance Guide and that the opportunity should be taken to make consequential improvements.

In addition, Annex 6.C also gives local authorities the power to require improvements in the energy performance of fixed building services in existing non-domestic buildings when they are altered or extended.

2.6.2 Conversions

In the case of a conversion, the requirements of Standard 6.3 (Non-domestic) should be met in so far as it is reasonably practical to do so and the overall efficiency of any installed systems should be no worse than any systems that existed pre-conversion.

Approved Certifiers of Design have a particular responsibility in determining what is reasonable. The regulations clearly aim to ensure that all new non-domestic buildings meet a minimum standard as set by a SBEM compliance calculation however with a conversion there is no requirement to undertake a SBEM compliance calculation.

The nature of buildings being converted, and the extent of the work required varies enormously from the conversion of a derelict or semi-derelict farm steading, where perhaps not much more than 4 walls are standing, to a change of use of a fully usable dwelling to an office with potentially no physical changes required.

Where existing space and hot water heating systems are largely retained in a conversion then the Approved Certifier of Design should consider what upgrades, such as the introduction of thermostatic radiator valves (TRVs), programmers and pipework insulation can be achieved. Any adjustments to the system, such as additional pipe runs to serve additional toilets etc must be treated as new works and meet relevant requirements of the Non-domestic Building Services Compliance Guide.

2.6.3 New Non-domestic Buildings

In undertaking a SBEM compliance calculation the Approved Certifier of Design must ensure that the systems as described in the calculation are those documented in the design as certified.

Where the design of the heating system is not fully available, for example when the choice of boiler is to be left to a specialist installer, then sufficient information to demonstrate compliance with the Non-domestic Building Services Compliance Guide should be included within the design to cover:

- Efficiency
- Fuel
- Location
- Controls
- Instructions
- Commissioning, etc

Where the design of the system is in part dependant on factors that can only be assessed during construction, (for example ground conditions which will dictate the design and efficiency of a ground source heat pump) or where there is more than one system attribute, which interact with each other to give an overall performance then these should be covered by a Schedule 1 and the design assumptions used in a SBEM compliance calculation recorded in the certification checklist.

2.7 Mechanical Ventilation and Air Conditioning - Domestic

The energy aspects of mechanical ventilation are addressed in the Domestic Building Services Compliance Guide. The drivers which cover the installation of mechanical systems are:

- the need to deal with moisture (and odours) in specific locations at specific times, such as bathrooms, and
- the requirement to provide sufficient air changes per hour in those areas where natural ventilation is not possible or restricted

There are four aspects to the energy impact of mechanical ventilation:

- the energy used by fans, controllers etc
- the energy lost by extracting warm air

- the potential for a mechanical vent heat recovery (MVHR) system or exhaust air heat pump (EAHP) which can recover useful heat which would otherwise be lost to the outside
- where cooling may be required

Standard 6.6 (Domestic) reinforces the assertion that air conditioning and mechanical ventilation which cool a dwelling are undesirable. Where they are included the Domestic Building Services Compliance Guide requires minimum controls and efficiencies of both air conditioning systems and mechanical ventilation systems.

2.7.1 Existing Dwellings

Except where a SAP compliance calculation is voluntarily used to demonstrate compliance of an altered or extended dwelling as a whole, the energy impact of ventilation and cooling is not calculated where existing dwellings are altered or extended.

Any new installations must comply with the requirements of Standard 3.14 (Domestic) where new rooms are created or their use changes, for example changing the use of a bedroom to a bathroom would require some localised ventilation to deal with odours and moisture.

The relevant efficiency requirements laid out in Domestic Building Services Compliance Guide apply to the installation of any new air conditioning systems and mechanical ventilation systems.

2.7.2 Conversions

In the case of a conversion the requirement of Standard 3.14 (Domestic) to provide adequate ventilation is likely to result in the installation of additional ventilation systems and whilst these may not be assessed in the form of a SAP compliance calculation the Approved Certifier of Design should consider the available strategies such as passive vents, local extract and mechanical vent heat recovery (MVHR) as they would for a new build.

Where an existing building has extract systems that are to be retained or adapted, again the Approved Certifier of Design should question the efficiency and energy consumption, particularly where the previous use required a much greater level of extraction. Standard 6.6 (Domestic) remains applicable to conversions "*in so far as is reasonably practical*".

2.7.3 New Dwellings

The choice of ventilation systems is an integral part of a SAP compliance calculation and, in setting the TER & TDER it is assumed that ventilation will be by a combination of natural background ventilation (trickle vents) and the same number of mechanical extract fans as the proposed dwelling.

Ventilation can also be achieved by passive stack vents and several different mechanical systems including mechanical vent heat recovery (MVHR) systems and exhaust air heat pumps (EAHP) which rely on using energy to power both extract and intake fans which is then offset by the heat recovered by the system. The overall efficiency of this strategy is dependent on the relative energy/$CO_{2(e)}$ emissions associated with the use of fans against that offset by a reduced heating requirement and fuel choice.

Clause 6.6.1 (Domestic) also requires the demonstration that a new dwelling will not overheat, avoiding the need for cooling. The assessment of the potential for overheating is addressed in Section 3.28 (Domestic). In certifying compliance with Section 6 – Energy (Domestic) the Approved Certifier of Design must ensure that the relevant calculations have been completed, that they are consistent with their own calculations and are submitted as part of the building warrant application.

As yet, Standard 6.6 (Domestic) does not limit energy usage associated with a cooling requirement however it seems likely that future regulations may well do, as is already the case south of the border. As a result, SAP includes a cooling load calculation which factors in the above as well as the use of internal blinds and curtains. RIAS – Energy Design Certification consider the utilisation of curtains and blinds as lying outwith any warrantable process and should therefore not be relied upon in a cooling load calculation.

2.8 Mechanical Ventilation and Air Conditioning – Non-domestic

The energy aspects of mechanical ventilation are addressed in Standard 6.6 (Non-domestic) as well as various clauses of both Standards 3.14 and 3.28 (Non-domestic). The drivers which cover the installation of mechanical systems are:

- the need to deal with moisture and odours in specific locations at specific times, such as toilets, and
- the requirement to provide sufficient air changes per hour, based on the use of the space, in those areas where natural ventilation is not possible or restricted
- the need to provide space cooling

There are four aspects to the energy impact of mechanical ventilation:

- the energy used by fans, controllers etc
- the energy lost by extracting warm air
- the potential for a mechanical ventilation or exhaust air heat pump system to recover useful heat which would otherwise be lost to the outside
- where cooling may be required

In more complex buildings it is not uncommon to install a full heating, ventilation and air conditioning (HVAC) system. Where these are covered by the Non-domestic Building Services Compliance Guide such systems may include heat recovery in order to increase system efficiency.

2.8.1 Existing Non-domestic Buildings

Except where a SBEM compliance calculation is voluntarily used to demonstrate compliance of an altered or extended non-domestic building, as a whole, the energy impact of ventilation and cooling is not calculated where they are installed.

Any new installations must comply with the requirements of Standard 3.14 (Non-domestic) where new rooms are created or their use changes. For example, changing the use of an office space to toilets would require some localised ventilation to deal with odours.

The efficiency requirements laid out in the Non-domestic Building Services Compliance Guide apply to the installation of any new mechanical ventilation air conditioning (MVAC) systems.

In addition, Annex 6.C also gives local authorities the power to require improvements in the energy performance of fixed building services in existing non-domestic buildings when they are altered or extended.

2.8.2 Conversions

In the case of a conversion the requirement of Standard 3.14 (Non-domestic) to provide adequate ventilation is likely to result in the installation of additional ventilation systems and whilst these may not be assessed in the form of a SBEM compliance calculation the Approved Certifier of Design should consider the available strategies such as passive vents, local extract, mechanical vent with heat recovery (MVHR), Exhaust Air Heat Pump (EAHP) and heating ventilation air conditioning (HVAC) systems as they would for a new build.

Where an existing building has extract systems that are to be retained or adapted, again the Approved Certifier of Design should question the efficiency and energy consumption of the existing system, particularly where a much greater level of extraction is required for the new use. Standard 6.6 (Non-domestic) remains applicable to conversions "*in so far as is reasonably practical*".

2.8.3 New Non-Domestic Buildings

The choice of ventilation systems is an integral part of a SBEM compliance calculation. For those buildings which include an element of mechanical cooling Standard 6.1 (Non-domestic) ensures that this

is taken account of in the BER/BDER elements of any compliance calculations. Equally Clause 6.6.1 (Non-domestic) highlights the impact of solar gains, heat gains from lighting and references guidance from the Chartered Institute of Building Services Engineers (CIBSE) which suggest that for office type spaces, the number of occupied hours above 28ºC should not exceed 1% of the annual occupied period.

Standard 6.1 (Non-domestic) also ensures that residential elements in non-domestic buildings, such as student housing, which are not covered by the Domestic Technical Standards are still assessed in line with Standard 3.28 (Non-domestic) which mirrors its domestic equivalent.

Module 3

Alterations, Extensions and Conversions

3. MODULE 3

Alterations, Extensions and Conversions

3.1 Introduction

Alteration, extension, and conversion covers a large area of possibilities from very minor alterations to an existing building, such as removing a window and providing a set of opening doors in their place, to potentially large projects such as the conversion of a historic mill into many flats or an office building.

In considering compliance with Standards 6.2 – 6.8 (Domestic and Non-domestic) and 6.10 (Non-domestic) it is worthwhile separating the issues into building envelope and services, for each type of occupancy, with a further mention of conservatories and stand-alone buildings associated with dwellings. The Approved Certifier of Design must however exercise judgement regarding which category or indeed combination of categories a particular project may fall into as the Building Standards apply different compliance thresholds and methods of demonstrating compliance in each circumstance.

For example, where an additional room is built on the side of a dwelling it is an extension, however where a previously unheated attic is "*converted*" to additional living space for use as part of the dwelling, then this is considered to be the conversion of a previously unheated building. Regulation 4 and the attendant Table 2 outlines these differences and Clauses 6.2.6 – 6.2.9 (Domestic) and Clauses 6.2.7 – 6.2.11 (Non-domestic) outline the requirements in each circumstance.

That being said, the 2023 revisions to Section 6 – Energy have simplified the target performance requirements for fabric elements, making them consistent whether an alteration, extension or conversion, as summarised in Table 6.2 (Domestic) and Table 6.3 (Non-domestic) to Clause 6.2.1 (Domestic and Non-domestic).

Schedule 6 to Regulation 12 states that for a conversion Standards 6.7, 6.8 and 6.10 (Domestic and Non-domestic) must be complied with in so far as they apply to the proposed conversion, as if the building were new, whereas Standards 6.2 – 6.6 (Domestic and Non-domestic) must be complied with in so far as

it is reasonably practical to do so and to ensure that in no case the completed works, perform more poorly than before the conversion.

Clause 6.2.7 (Domestic) and 6.2.8 (Non-domestic) provides guidance in relation to the conversion of "*Historic, Listed and Traditional Buildings*". The definition of these lies in the Building Standards Division's Procedural Handbook and echoes that in Historic Environment Scotland's Guide to Practitioners No 6 Conversions of Traditional Buildings:

Historic building means a building of architectural or historic interest. A historic building does not have to be listed by Scottish Ministers or lie within a conservation area to be deemed to have special interest or significance;
Listed building means a historic building, which has been included in a statutory list because of its special architectural or historic interest; and
Traditional building means a building or part of a building of a type constructed before or around 1919;
a. using construction techniques that were commonly in use before 1919; and
b. with permeable components, in a way that promotes dissipation of moisture from the building fabric.

Clause 6.2.8 (Domestic) also allows a "whole dwelling approach" where a SAP compliance calculation can be used to show that an existing dwelling plus a proposed extension meets the requirements of Standard 6.1 (Domestic) as if it was an entirely new dwelling. Such an approach is only likely to be viable for very new dwellings (where a full description of the dwelling construction and services is available) or perhaps ones which are undergoing a significant refurbishment at the same time as being extended.

Similarly Clause 6.2.9 (Non-domestic) allows a SBEM compliance calculation to be used to show that either the proposed extension in isolation or the existing building as extended meets the requirements of Standard 6.1 (Non-domestic) as if it were an entirely new building. Where the extension meets the criteria defining a large extension, defined in paragraph a.(ii) to Standard 6.1, a SBEM compliance calculation of the extension is required.

Clauses 6.2.11 and 6.2.12 (Domestic) give guidance with regard to conservatories and stand-alone buildings associated with dwellings.

Clause 6.2.11 (Domestic) reinforces the requirement to ensure that conservatories, which are still treated as standalone buildings, are to be insulated on the basis that whether intended to be or not they are frequently heated. Clause 6.2.12 (Domestic) states which compliance methodology that applies for stand-alone buildings based on their floor area.

Appendix 6.A gives two examples of "*Compensatory Heat Loss*" calculations, where the performance and area of elements can be adjusted, as long as, in total, they meet or exceed the requirements imposed using the maximum area of openings possible (under the elemental method) and the U-values in Table 6.2 to Clause 6.2.1 (Domestic) or in Tables 6.3 to Clause 6.2.1 (Non-domestic).

Appendix 6.A allows a "*Compensatory heat Loss*" calculation to cover more than one element of a particular building, for example a dormer extension and a separate single storey extension can be considered together, as long as the same assessment criteria are applicable to each element of work. This allows for example more glass to be incorporated in a new dormer balanced by a higher performance in an extension.

Where the project consists of the conversion of a Historic, Listed or Traditional building then neither calculation need be used. It is still recommended that the existing building fabric be upgraded to meet the U-values noted in Table 6.2 to Clause 6.2.1 (Domestic) or in Table 6.3 to Clause 6.2.1 (Non-domestic), or as close as practical possible. Regardless, where the values in Tables 6.2 or 6.3 are not achievable, upgrading to at least the backstop U-values of 0.7 for walls and floors, 0.35 for roofs and 3.3 for glazing, to control surface condensation should be considered. Only if that impacted on historically important fabric would no action be acceptable to specific elements.

Approved Certifiers of Design should be mindful that the improvement of fabric and services elsewhere in the conversion of a historic, listed or traditional building remains an overall requirement of Clause 6.2.7 (Domestic) and Clause 6.2.8 (Non-domestic).

Caution must also be exercised to ensure that the introduction of new fabric to the existing building is neither detrimental to the historic value of the building nor to the performance of the existing building fabric.

Where significant fabric upgrades are not achievable then if possible, other improvements should be made elsewhere to improve the energy performance of the building and where the works consist of rebuilding part of the external envelope the opportunity should always be taken to improve the performance as long as this can be achieved without impacting on compliance with the Building Standards as a whole.

3.2 Building Envelope

3.2.1 Alterations to the Building Envelope

Clause 6.2.10 (Domestic) and Clause 6.2.11 (Non-domestic) covers those circumstances where the insulating envelope is being altered either by:

- a change in the area, or location of openings;
- the insulation envelope is altered to include a previously internal element of the building; and
- the reconstruction of elements forming part of the building insulation envelope

In each instance the U-values in Table 6.2 to Clause 6.2.1 (Domestic) or in Table 6.3 to Clause 6.2.1 (Non-domestic) should be adopted, although there is some leeway given in the case of infilling smaller openings and the provision of secondary glazing.

Clause 6.2.10 (Domestic) limits the overall area of openings to 25% of the total floor area of the dwelling, which would prevent the introduction of a new opening if the dwelling had already reached that limit unless a compensatory approach has been taken - see paragraph 2.3.3 above.

Clause 6.2.11 (Non-domestic), places not limit on the area of new openings created, as long as they meet the requirements of Table 6.3 to Clause 6.2.1 (Non-domestic), unless they are display windows, as defined in Clause 6.2.2 (Non-domestic) in which case there is no limit on their U-value, as long as it is compensated by fabric improvements elsewhere in the building.

3.2.2 Extensions to the Building Envelope

As with alterations to the envelope of a building the simplest solution is to design an extension to the U-values in Table 6.2 to Clause 6.2.1 (Domestic) or in Table 6.3 to Clause 6.2.1 (Non-domestic).

Clause 6.2.8 (Domestic) limits the area of openings to 25% of the overall additional floor area + the area of any openings that have been built over. Further flexibility is provided by the use of a compensatory heat loss calculation to allow, for example more glazing, if that glazing and/or other elements have an improved U-value.

Clause 6.2.9 (Non-domestic) limits the area of openings by use, as noted in Table 6.4. Again, further flexibility is provided by the use of a compensatory heat loss calculation to allow, for example more glazing, if that glazing and/or other elements have an improved U-value.

Approved Certifiers of Design should remain mindful that when "*converting*" an attic or a garage, to additional dwelling spaces, these should be considered as a conversion under Schedule 2 to Regulation 4 in respect to the application of the Building Standards either in full or as far as is reasonably practicable (see Schedule 6 to Regulation 12), this assumes that they have previously been thermally separated from the dwelling, unheated and are non-habitable spaces.

In both domestic and non-domestic buildings, the heat loss of the proposed extension is the sum of the heat loss through each element of building fabric ie its actual area multiplied by its U-value. Crucially the total envelop area of the notional extension must equal to the corresponding proposed extension.

In the notional domestic extension, the area of floors and roof are adjusted to ignore any openings, whereas the area of the walls is adjusted to allow the total area of openings to equal 25% of the additional floor area + built over openings. In other words, in the notional extension it assumes that all of the openings are concentrated in the external walls.

An example of this calculation is given in Annex 6.A of the Domestic Building Standards.

In the notional non-domestic extension, the area of roof and walls are adjusted to allow for the maximum permitted area openings allowed in Table 6.4 to Clause 6.2.9 (Non-domestic). An example of this calculation is given in Annex 6.A of the Non-domestic Building Standards.

From 1st October 2015, larger Non-domestic extensions as defined in paragraph a.(ii) of the limitations to Standard 6.1 have been treated as if new buildings requiring a SBEM compliance calculation, for the extension.

In addition, Clause 6.2.9 (Domestic) and Clause 6.2.10 (Non-domestic) requires the guidance in *BRE Report 262 (2006): Thermal insulation, avoiding risks'* to be considered and applied.

Clause 6.2.8 (Domestic) also allows a SAP compliance calculation to be used to show that an existing dwelling plus a proposed extension meets the requirements of Standard 6.1 (Domestic) as if it was an entirely new dwelling. Such an approach is only likely to be viable for very new dwellings (where a full description of the dwelling construction and services is available) or perhaps ones which are undergoing a significant refurbishment at the same time as being extended.

Similarly, Clause 6.2.10 (Non-domestic) allows a SBEM compliance calculation to be used to show that either the proposed extension in isolation or the existing building as extended meets the requirements of Standard 6.1 (Non-domestic) as if it were an entirely new building, even if the extension does not meet the criteria where this would be obligatory.

3.2.3 Introducing Heating to Previously Unheated Building(s) or Part thereof and Conversion of Buildings

As with alterations to the envelope of a building the simplest solution is to design an extension to the U-values in Table 6.2 to Clause 6.2.1 (Domestic) or in Table 6.3 to Clause 6.2.1 (Non-domestic).

Clause 6.2.6 (Domestic) limits the area of openings to 25% of the overall floor area. Further flexibility is provided by the use of a compensatory heat loss calculation to allow more glazing, if that glazing and/or other elements have an improved U-value.

Clause 6.2.7 (Non-domestic) does not limit the area of openings. As a result, a compensatory heat loss calculation need not be considered as an option.

3.2.5 Conversion of Historic, Listed or Traditional Buildings

Clause 6.2.7 (Domestic) and 6.2.8 (Non-domestic) recognise both the importance of historic, listed and traditional buildings and the significant challenges that they pose when attempting to improve their energy efficiency. BSD and Historic Environment Scotland have jointly prepared the 2 part Guide for Practitioners 6 - Conversion of Traditional Buildings - Parts 1 and 2, published Feb 2010, available at: www.scotland.gov.uk/Topics/Built-Environment/Building/Building-standards/publications/pubtech/thbksupguidce

The guiding principle is that where it is possible and practical to improve insulation levels, without adversely affecting the historic fabric, improvement work should be carried out. This is subject, of course, to ensuring that such works also comply with Building Standards generally, as set out and qualified elsewhere in the Technical Handbooks.

The overall aim of Section 6 - Energy of the Building Standards is to ensure effective measures for the conservation of fuel and power are incorporated in buildings and in the case of converting a historic, listed or traditional building. The Building Standards require applicants to "*do as much as they can*" as far as is

"*reasonably practicable*". This puts a particular emphasis on the Approved Certifier of Design's role in that there is no double check on what is considered reasonable by the local authority Verifier.

The Building Standards state: *"**Reasonably practicable** in relation to the carrying out of any work, means reasonably practicable having regard to all the circumstances including the expense involved in carrying out the work".*

Section 6 - Energy of the Technical Handbook also states that in all cases, thought should be given to how energy efficiency could be improved. *"Innovative but sympathetic and practical solutions to energy efficiency …. can often result in an alternative package of measures being developed for a* historic (ed) *building. For example, carbon dioxide emissions can be reduced without affecting building fabric through improvements to the heating system (refer to Standards 6.3, 6.4), the lighting system (refer to Standard 6.5), or incorporation of low carbon equipment (such as a biomass boiler or heat pumps)."*

Definitions of historic, listed and traditional are given under paragraph 3.1 above. Clause 6.2.7 (Domestic) and 6.2.8 (Non-domestic) reinforces the fact that this definition is not included in the Building Standards as a "*get out of jail free*" card but states that the ambition should be to achieve the U-values noted in Table 6.2 to Clause 6.2.1 (Domestic) or in Table 6.3 to Clause 6.2.1 (Non-domestic), or as close as practical possible.

Where the values in Tables 6.2 or 6.3 are not achievable, upgrading to at least the backstop U-values of 0.7 for walls and floors, 0.35 for roofs and 3.3 for glazing, to control surface condensation should be considered.

Only when there are overriding circumstances where even this cannot be achieved should these requirements be relaxed. Such circumstances might be for example:

- statutory protection through listing etc prevents upgrading, such as replacing sash and case windows
- in traditional solid wall construction, there is no cavity into which to introduce insulation
- voids in traditional slated coombs cannot be filled without losing a ventilation path

The onus remains however to "*do what you can*" for example sash and case windows can be draft proofed and systems for replacing the glazing with very thin double-glazed units or providing inner demountable double glazed secondary windows may be acceptable to statutory authorities.

In each case the Approved Certifier of Design must take care with regard to any proposed interventions, in particular the inclusion of insulation within existing cavities, giving due regard to the possibility of interstitial condensation and the impacts of water penetration.

3.2.6 Thermal Bridging

Guidance recognises that the proportion of the insulating envelope that is thermally bridged has an impact on the overall thermal performance of a building. Thermal bridging occurs in both repeating elements (such as timber studs in an insulated timber frame) and non-repeating elements such as at the interface between planes in the building envelope, around openings, etc.

Repeat thermal bridges are taken account of within standard U-value calculations which have the capacity to include a proportion of thermal bridging in each layer of the construction and which must comply with the relevant Section of the Technical Handbooks.

Clause 6.2.3 (Domestic) and Clause 6.2.4 (Non-domestic) cover the requirements to minimise non-repeating thermal bridging elements. However Approved Certifiers of Design must be particularly mindful of those other parts of the Standards that may be impacted by the specific design. For example; Approved Certifiers of Design should consider how the design will limit thermal bridging around elements such as cavity barriers in an external cavity wall.

Reference should be made to the *BRE Report 262 (2006): Thermal insulation, avoiding risks'* (which is described in detail in Section 2.3 above) and gives advice on minimising thermal bridging and unwanted air infiltration.

The infilling of openings to the existing insulating envelope is particularly prone to the proliferation of thermal bridges as a proportion of the overall element and this should be limited by designing elements to avoid thermal bridging.

With extensions to an existing dwelling, it is possible to adopt strategies applicable to new dwellings, although there is an acceptance in the Building Standards that there will be an element of thermal bridging at wall starters etc.

Where a conversion includes measures for improving the thermal performance of external fabric the proportion of thermal bridging inputted in U-value calculations should reflect as closely as possible the actual design, for example where lining internally with insulation between timber straps, the impact of the actual geometry of the existing wall and the requirement for dwangs and fixings should be quantified.

3.2.7 Air Infiltration

As with thermal bridging, air-tightness can have a significant impact on the thermal performance of the insulating envelope of a building and is covered by Clause 6.2.4 (Domestic) and Clause 6.2.5 (Non-domestic).

The Building Standards do not require an air-tightness test of a building after alteration, extension or conversion, except for large non-domestic extensions or where compliance has been demonstrated by either a SAP or SBEM compliance calculation.

Once again reference should be made to *BRE Report 262 (2006): Thermal insulation, avoiding risks'* which is described in Section 2.3 above. Approved Certifiers of Design should be particularly mindful that as levels of airtightness are improved, consideration must be given to both the potential for interstitial condensation within the built fabric and the restriction of natural ventilation for building occupants.

Approved Certifiers of Design must take care not to inadvertently create an overly air-tight building through a combination of alteration, extension, or conversion that due to the method of compliance goes untested and therefore the requirements of Standard 3.14 for adequate ventilation is not then met.

For example, a farm steading conversion may take the form of a concrete floor, plastered block inner leaf with insulation to the cavity and a fully filled breathing roof, well taped and boarded internally. Assuming new windows are fully sealed to the opening a very low air infiltration rate can be achieved, but under either the elemental or compensatory method of compliance no test would be required.

3.3 Conservatories, Stand Alone Buildings and Common Areas in Buildings within Multiple Dwellings

Conservatories are defined as rooms which are thermally separate from the dwelling to which they are attached and have a high proportion of translucent material in their external envelope. Either a minimum of 75% of the roof plus 50% of the external wall area, or 95% of the roof plus 35% of the external wall area.

If less than 50m^2 in overall floor area Clause 6.2.11 (Domestic) applies which requires the elemental U-values (other than glazing) to meet the requirements Table 6.2 to Clause 6.2.1 (Domestic). The maximum area weighted U-value of the glazed element of the conservatory is, however, relaxed to 1.8 with a backstop value of 3.3 for any individual section of glazing.

Clause 6.2.11 (Domestic) also refers to the guidance in Clause 6.2.9 (Domestic) with regard to minimising both thermal bridging and air infiltration.

A standalone building, such as a sunroom, is one which is thermally separate from a dwelling but does not include the extent of glazing (although that glazing may be extensive) which qualifies it as a conservatory. Clause 6.2.12 (Domestic) refers to the U-values in Table 6.2 to Clause 6.2.1 (Domestic) the area of glazing is however unlimited.

If the overall floor area of a conservatory or a standalone building is greater than 50m^2 it must be assessed under Standard 6.1 (Non-domestic) using a SBEM compliance calculation.

Where common heated areas (totalling less than 50m^2 in floor area) are provided for a number of dwellings as part of a new building, such as a heated sitting or laundry room, they may be treated as a standalone building ancillary to a dwelling. The fabric U-values used to set the notional target in Standard 6.1 should be adopted and the total area of openings must be restricted to 25% of the floor area, unless a compensatory heat loss calculation is undertaken to compare a notional common space which meets these requirements with the actual proposals.

Where common heated areas (exceed 50m^2 in floor area) are provided for a number of dwellings, as part of a new building, Standard 6.1.5 (Domestic) applies. This provides the choice of demonstrating compliance as described above or by a SBEM compliance calculation if the above criteria are not met.

Regardless of the method of compliance followed, the latest changes require an EPC for common heated areas which exceed 50m^2, based on an SBEM calculation.

3.4 Building Services

When altering, extending, or converting a building the existing heating and hot water installations may remain intact but are more likely to be altered, extend or fully replaced. Standard 6.3 (Domestic) and (Non-domestic) together with the Domestic and Non-domestic Building Services Compliance Guides provide minimum efficiencies for all the commonly encountered heating systems and their controls. Where a heating and hot water system is replaced in its entirety then the Standards and Guides must be followed in their entirety as if for a new building.

Where a heating system is altered piecemeal then the requirements of the Domestic or Non-domestic Building Services Compliance Guide must be followed for those pieces of equipment which are being replaced or added.

Annex 6.C^ (Non-domestic) also gives local authorities the power to require improvements in the energy performance of fixed building services in existing non-domestic buildings when they are altered or extended.

In addition, the opportunity should be taken to make any other improvements to the system when the opportunity arises, for example by the addition of Thermostatic Radiator Valves (TRV's) or indeed the replacement of older faulty valves while a system is temporarily decommissioned.

Both the Domestic and Non-domestic Building Services Compliance Guides requires pipes and hot water cylinders etc to be insulated in accordance with BS 5422 and applies to both completely new systems and system alterations. Standard 6.4 states that "*every building must be designed and constructed in such a way that temperature loss from heated pipes, ducts and vessels, and heat gain to cooled pipes and ducts is resisted*" for work that is being conducted on existing buildings the following applies:

- where a new or replacement boiler or hot water storage vessel is installed, or where existing systems are extended, new or existing pipes that are accessible or exposed as part of the work should be insulated as if for a new system
- where a hot water storage vessel is replaced then the Domestic Building Services Compliance Guide places a limit on the heat loss from a replacement hot water vessel (cylinder or thermal store) in line with the requirement for new builds.

Complete insulation is not always possible, particularly where services might pass through or around structural building components such as floor joists, however the principle remains that whether a new system is installed, or alterations made to an existing system, the opportunity to optimise the efficiency of the system overall must be taken.

The redrafting of Standard 6.3 has removed an explicit reference to heating systems within Traditional, Listed and Historic buildings the definition of which is given in paragraph 2.3 above. However, Clause 6.2.7 (Domestic) and 6.2.8 (Non-domestic) retains the principle that each building should be examined on a case by case basis and that the guidance in the Domestic and Non-domestic Building Services

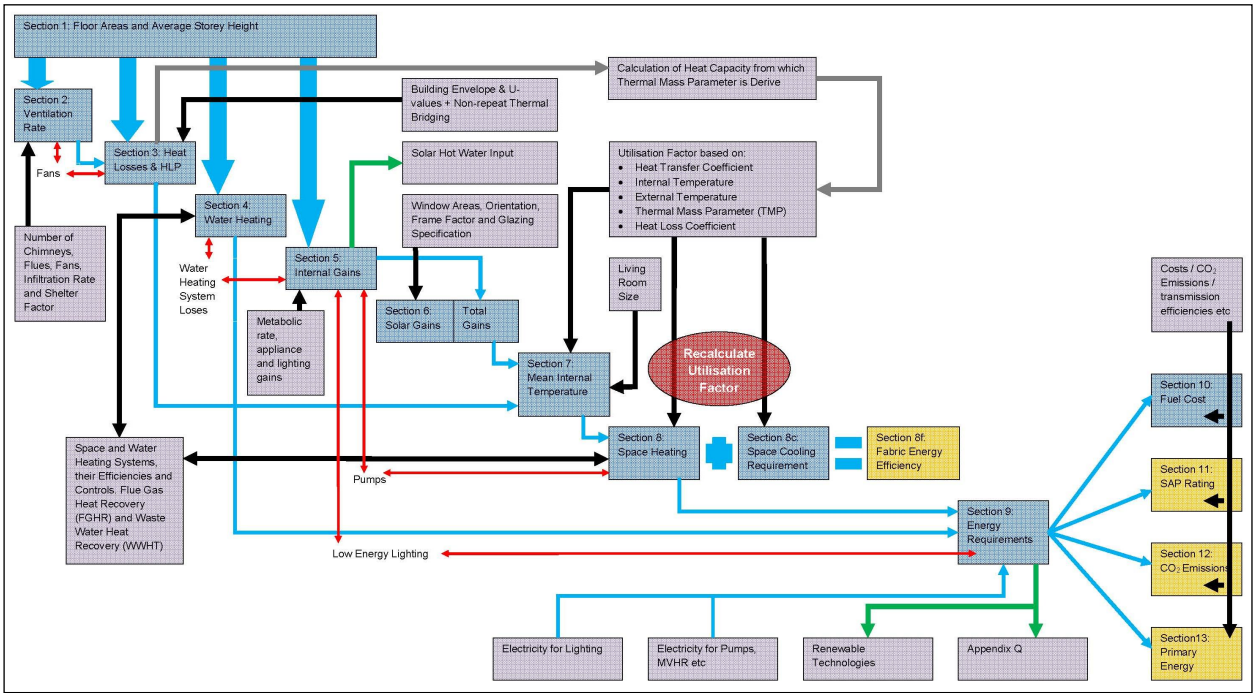
Compliance Guides should be followed as far as is possible. Both clauses go further and recognise that in most cases, heating system improvements will be more feasible than employing other energy efficiency measures such as improving wall insulation. Therefore, systems which go beyond the minimum back-stop levels may help offset the deficiency of energy efficiency in other areas and help reduce energy use and $CO_{2(e)}$ emissions.

Module 4A

Calculation Methods for New Dwellings

4A. MODULE 4A

Calculation Methods for New Dwellings



SAP Process Diagram[1]

4A.1 Introduction

This Module deals primarily with compliance with Standard 6.1 (Domestic) of the Building Standards which seeks to control the energy use of and $CO_{2(e)}$ emissions from new dwellings in use. In order to do this Standard 6.1 (Domestic) requires every new dwelling to meet or not exceed a Target Delivered Energy Rate (TDER) and for those whose heating is not by some form of electric heat pump a Target $CO_{2(e)}$ Emissions Rating (TER) remains in place.

The TDER and TER (where applicable) for each new dwelling is set using the National Calculation Methodology adopted by the Scottish Government for the purpose of demonstrating the compliance of new dwellings with the building regulations. From the 1st February 2023, this is the Standards Assessment Procedure (SAP10.2) and a list of approved software can be found, by following the link at: https://bregroup.com/sap/sap10/

The origins of SAP lie in the Building Research Establishment Domestic Energy Model (BREDEM) which was based on energy monitoring undertaken from the mid 1970's to the mid 1980's. BREDEM evolved through several versions eventually being codified as SAP2001, which was based on BREDEM-9 and subsequently evolved via SAP2005, SAP2009 and SAP2012, into SAP10.2 which includes eight separate calculations:

1. the Energy Efficiency (SAP) Rating which appears on Energy Performance Certificates (EPC)
2. the Environmental Impact Rating (EIR) calculation which also appears on EPCs
3. a Dwelling Delivered Energy Rate (DDER)
4. a Target Delivered Energy Rate (TDER)
5. a Dwelling $CO_{2(e)}$ Emissions Rating (DER)
6. a Target $CO_{2(e)}$ Emissions Rating (TER)

[1] Reprinted from - Atkins, Emmanuel, 2012, "*WHICH IS THE BEST TOOL TO ASSESS ZERO ENERGY HOUSING?*": Conference proceedings ZEMCH 2012 pp 175-186

7. Fabric Energy Efficiency (FEE), this calculation has no regulatory function in Scotland
8. a "Regulations Compliance Report", which include both average U-value and excess emissions and energy calculations - ***This must not be relied upon by an Approved Certifier of Design (Section 6 - Energy) Domestic as proof of compliance***.

For the purposes of demonstrating compliance only 2 - 4 are relevant. These provide comparative energy requirement, energy cost and $CO_{2(e)}$ emissions predictions for a dwelling considering orientation, massing, fenestration, fabric and system performance based on a set of use parameters related to floor area and applied consistently to every design.

Compliance with Standard 6.1 (Domestic) can be demonstrated by:

- undertaking an individual SAP compliance calculation for each dwelling within a project, where a project exists of multiple identical dwellings which vary, only by orientation, compliance calculations of each orientation are now required to be provided as part of the building warrant application
- where there are minor variations in performance across a number of units in a terrace or block, and individual units fall below the threshold for compliance, compliance can be demonstrated by an area-weighted calculation of the results, which group the individual SAP compliance calculations a specific block or terrace

Approved Certifiers of Design must be mindful that aside from orientation, there can often be many small differences between dwellings, such as units both with and without a hipped feature planted on a roof, which is sufficient, due to the differences in thermal bridge, to necessitate a separate SAP compliance calculation.

In addition, the area-weighted DER/DPER calculation option should not be applied across an entire building warrant application, unless the project consists of a single continues terrace of houses or a single block of flats. Where a building warrant application consists of multiple terraces and/or blocks, each of these should be assessed by an individual area-weighted calculation if required.

4A.2 The Standard Assessment Procedure (SAP) 2012

It is a requirement of the RIAS-regs Scheme that all Approved Certifiers of Design must use current approved software for all SAP compliance calculations.

SAP is an asset rating[1] as opposed to an operational rating[2] assessment assumes that heating patterns and temperatures are generally consistent for all dwellings. The only variation occurs when certain heating systems, such as heat pumps, which are designed to operate 24/7 over-ride the assumptions built into the SAP Methodology for the DER and DDER calculations.

Hot water demands relate primarily to floor area and varies only with the number of showers provided. Internal heat gains from hot water systems and lighting vary with that proposed, whereas gains from metabolic rate, appliances etc are related only to floor area. Orientation and areas of openings (and therefore both heat loss and solar gain) now vary with the proposals, unless the total area exceeds 25%, in which case glazed openings are reduced in the TER and TDER calculations.

The calculations are based upon the energy used for heating, domestic hot water and fixed lighting, taking into account a range of factors that contribute to energy efficiency within a dwelling, including the:

- materials used for construction of the dwelling
- thermal insulation of the building fabric
- ventilation characteristics of the dwelling and ventilation equipment
- efficiency and control of the heating system(s)
- solar gains through openings of the dwelling
- fuel used to provide space and water heating and run pumps and fans etc

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1 An asset rating seeks to provide a rating based on a pre-defined pattern of use common to all dwellings.
2 An operational rating is based on the actual energy used by a particular building and is partly dependant on the particular pattern of use.

- fuel used for lighting
- the impact of low or zero carbon technologies (LZCGT)
- the provision of electrical battery storage or PV diverters which use surplus generation to heat hot water

To demonstrate compliance with Standard 6.1 (Domestic) the calculated Dwelling Delivered Energy Rate (DDER) must be ≤ the level of Target Delivered Energy Rate (TDER) calculated for all new dwellings and for those whose primary heating is not by a zero emissions heating system, such as an electrically powered air source heat pump (ASHP) the Dwelling $CO_{2(e)}$ Emission Rate (DER) must also be ≤ the level of the Target $CO_{2(e)}$ Emission Rate (TER).

Default assumptions for the calculation of both targets are set from the values in Tables 6.1 to Clause 6.1.2 (Domestic). The notional performance of the built fabric, ventilation and hot water demand is no longer varies with the main heating fuel.

The notional heating system type and its controls and efficiencies now fall into one of three categories:

ASHP:	Target assumes a default performance
Heat network:	Target matches the proposed heat network
All other solutions:	Target assumes a default gas boiler and controls (with or without a HWC to match the proposed building). Where a HWC is proposed a default heat daily heat loss is assumed based on volume.

Apart from the ASHP category the installation of a photovoltaic array is assumed, based on floor area and available roof area, adjusted to allow for multi-storey blocks of flats and/or maisonettes.

The all calculations use a single set of Scottish climate data (Glasgow) regardless of the location of the proposed development.

Compared to SAP2005, SAP2009 calculated space and water heating on a monthly rather than annual basis and many indices and assumptions were amended and updated and additional information was required regarding:

- party wall U-values,
- thermal mass, and
- thermal bridging etc

The overall aim of the 2015 revisions to Standard 6.1 was to achieve a 21.4% aggregate reduction in $CO_{2(e)}$ emissions compared to the 2010 Building Standards. The revisions to SAP2012 include the changes to the assumptions made in the TER calculation and additionally in both TER and DER calculations:

- a zero U-value for separating walls is now included (previously 0.20 was used to take account of thermal bypass) an allowance for height above sea level is incorporated into external temperature data
- $CO_{2(e)}$ emission factors have been revised
- fuel price and primary energy factors have been revised
- the options for heat losses from primary pipework have been extended
- there are additional non-repeat linear thermal bridges included
- climatic data has been extended to allow calculations using regional weather which will impact on infiltration, solar thermal and PV performance
- electric showers are included
- more heating controls are available
- more duct work options for mechanical ventilation systems are included
- manufacturers data for boilers cannot be used for an EPC

The 2022 revisions to Standard 6.1 recognises the transformation in Scottish electricity generation, which has achieved near net zero $CO_{2(e)}$ emissions. This has been recognised by the presumption that the use of mains electricity has net zero Direct $CO_{2(e)}$ emissions (NZDE) at the point of use.

This reduces the effectiveness of using TER/DER SAP compliance calculations in promoting overall energy efficiency for electrically heated dwellings and these have been withdrawn for those dwellings heated by a heat pump.

Alongside TER/DER SAP compliance calculations TDER/DDER SAP compliance calculations have been introduced for all new dwellings which sets an energy target as the main measure of overall energy efficiency of new dwellings.

The TER/DER SAP compliance calculations remain in used (alongside the TDER/DDER compliance calculations) for all non-heat pump heated dwellings and the target setting assumptions have been updated to achieve a 32% aggregate reduction in $CO_{2(e)}$ emissions compared to the 2015 Building Standards for those new dwellings. The revisions to SAP10.2 apply to all compliance calculations:

- fuel prices, CO2 emissions and primary energy factors have been updated
- the monthly variation of CO2 and primary energy factors is now taken into consideration
- the calculation of hot water consumption has been adjusted to take account of the flow rate of showers, the number of showers and whether or not baths are present in the dwelling
- the calculation of lighting energy has been updated to allow for the lighting efficacy and amount
- the treatment of distribution loss factors associated with communal heating networks has been revised
- the air flow rates associated with chimneys and flues have been updated
- the treatment of mechanical ventilation system heat recovery and aerodynamic performance has been revised
- additional flow temperature options have been provided for heat pumps and condensing boilers and a means to recognise hybrid heat pump/boilers added
- the self-use factor for electricity generated by photovoltaic (PV) systems has been revised and allows for the effects of battery storage and PV diverters
- the ability to include solar thermal space heating has been added
- the assumed standard heating pattern has been adjusted to better match UK practice
- provision has been made to include heat interface units (for heat networks), new heating controllers and additional fuels in the PCDB
- the reference building characteristics have been updated
- results from low pressure pulse testing have been allowed for in the calculation of infiltration rate
- Appendix P (summer gains check) has been removed
- the efficiency of wastewater heat recovery (WWHR) systems now vary with shower flow rate.

4A.3 Environmental Impact Rating

The Environmental Impact (EI) Rating is based on the annual $kgCO_{2(e)}/m^2$ emissions associated with space heating, water heating, ventilation, and lighting, less the emissions saved by energy generation technologies. The EI Rating is expressed on a scale of 1 to 100, where the higher the number the better the standard, it is calculated alongside the SAP Rating and appears on an Energy Performance Certificate (EPC).

4A.4 The SAP Rating

The SAP Rating is based on the energy costs per m^2 of the dwelling associated with space heating, water heating, ventilation and lighting, less cost savings from energy generation technologies. The SAP Rating is expressed on a scale of 1 to 100, where the higher the number the lower the running costs. There are limited changes to the calculation of the SAP Rating between different versions of the SAP methodology, to ensure that EPCs remain a comparative indicator between dwellings of different types, sizes and designs.

4A.5 The Dwelling Delivered Energy Rate

The Dwelling Delivered Energy Rate (DDER) is used for the purposes of compliance with building regulations for all new dwellings. It is equal to the annual energy per unit floor area for space heating, water heating, ventilation and lighting, less the emissions saved by energy generation technologies, expressed in kWh/m^2/year.

4A.6 The Dwelling $CO_{2(e)}$ Emission Rate

The Dwelling $CO_{2(e)}$ Emission Rate (DER) is used for the purposes of compliance with building regulations, for all new dwellings other than those primarily heated by a heat pump. It is equal to the annual $CO_{2(e)}$ emissions per unit floor area for space heating, water heating, ventilation and lighting, less the emissions saved by energy generation technologies, expressed in kg/m^2/year.

The DER and Environmental Impact (EI) Rating while closely related do differ. The DER assumes the lower internal gains from metabolic rate, lighting, appliances and cooking from Column B to Table 5, page 177 of SAP10.2 which means the DER is greater than the EI Rating.

4A.7 The Fabric Efficiency Emission Rating

The Fabric Energy Efficiency (FEE) equals the Space Heating + Cooling Requirements measured per m^2 of floor area. The FEE calculation is based on Section 11, page 34 of SAP10.2 and assumes:

- climate is UK average for heating and cooling
- natural ventilation with intermittent extract fans – with (6a) to (6f) and (7b) and (7c) set to zero.
- 2 extract fans for total floor area (TFA) up to 70 m2, 3 for TFA > 70 m2 and up to 100 m2, 4 for total floor area > 100 m2; set chimneys, flues and passive vents to zero.
- for calculation of heat gains from the hot water system worksheet (46) to (61) inclusive and (63) are set to zero (equivalent to an instantaneous water heater);
- showers and baths: one 9.3kW instantaneous electric shower, bath also present
- dwelling design achieves water use target of not more than 125 l/day
- fixed lighting capacity (lm) = 185 x TFA, efficacy of fixed lighting = 66.9lm/W
- column (B) of Table 5 is used for internal gains in the heating calculation
- column (A) of Table 5 is used for internal gains in the cooling calculation
- overshading of windows not less than average (i.e. very little is changed to average)
- no heat gains from pumps or fans
- the heating system has responsiveness 1.0 and control type 2, no temperature adjustment, temperature and heating periods according to Table 9 irrespective of the actual heating system
- cooled fraction is1.0

Other data items are those for the actual dwelling. The above are special conditions for calculation of Fabric Energy Efficiency and do not apply for TER/DER/EI Rating and SAP Rating calculations. The FEE rating is not currently used in demonstrating compliance in Scotland.

4A.8 General Principles of the Standard Assessment Procedure

Approved SAP software systems include within them a number of different calculations used for different purposes. Each of the calculations follow the same broad procedure applying different rules depending on which particular calculation is being performed. The software requires information to be inputted once and then uses this to populate each calculation as appropriate.

The Standard Assessment Procedure is composed of thirteen Sections (although not all are used as per the diagram at the front of this module) and it is set out in the form of a worksheet accompanied by a series of tables.

The following should be read with reference to the Standard Assessment Procedure Worksheet version 10.2 which starts on page 131 of the PDF version of SAP10.2 dated April 2022. The naming of the sections reflects the SAP10.2 document.

4A.8.1 Section 1 – Dwelling Dimensions

The overall dwelling dimensions are required for two key reasons, firstly the floor areas are used to calculate the occupancy characteristics further down the spread sheets and secondly the areas are multiplied by the storey height to give the volume within the insulating envelope of the dwelling, which is used to calculate the heat lost through air infiltration and ventilation in Section 2 of SAP10.2.

In both cases the dimensions are measured from the inside surface of the external insulated envelope and in the case of heights they are measured downwards from the roof. Some care needs to be taken where a pitched roof is insulated between the rafters to the ridge and where there is also a small area of flat ceiling near the apex.

In this instance the volume above the ceiling is excluded from the average height calculation as the still air is not subject to air infiltration due to fans, chimneys etc however in Section 3 of SAP10.2 which quantifies the heat loss through the building envelop the lowered ceiling is ignored and the full area of the pitched roof is measured.

In calculating floor areas and average heights an element of judgement is needed on the part of an Approved Certifier of Design. For example, for common building types where the external wall may be of the order of 300mm thick the internal wall line can be considered as enclosing the volume and door and window reveals ignored.

Where different construction types adopt very much thicker walls the reveals can add substantially to the overall volume (particularly in a small highly glazed dwelling) and should be considered.

Equally where an attic is part of the habitable space and dormers rise above the general line of the pitch, the volume of these should be included, but not the depth of reveals to roof lights.

No firm guidance is given within Standard Assessment Procedure (SAP) on the two points above however the RIAS-regs Scheme Practical SAP Test follows both these principles.

Care is also needed by the Approved Certifier of Design to ensure that all those spaces that are considered usable and/or are required to demonstrate compliance with the Standards (together with circulation thereto) are considered as being inside the insulated envelope of the dwelling even if no fixed means of heating is provided to such spaces as these spaces are still required to be heated as per Standard 3.13 (Domestic).

4A.8.2 Section 2 – Ventilation Rate

As dwellings are increasingly well insulated the impact of ventilation becomes proportionately more significant. This section of SAP10.2 quantifies the rate at which the outside air enters and leaves a dwelling, called the air change rate and to which the volume of the building is subject to. The more air that enters the building and the colder the air relative to the internal temperature the greater the energy required to maintain comfortable in door temperatures.

Ventilation can take place through a series of means, controllable or not:

1. open of windows
2. trickle vents
3. combustion air vents
4. air infiltration through the building fabric
5. passive and/or mechanical ventilation systems
6. flues and chimneys

Elements in 1, 2 and 3 are not quantified in compliance calculations. Elements 4 and 5 make up the ventilation rate as each of them acts to remove warm air from the dwelling, which must be replaced by cooler air which must ultimately be heated up. The ventilation rate is combined with the air infiltration rate, (adjusted by the sheltering effect) to give the air change rate.

Ventilation Rate

Measured in air changes per hour the ventilation rate is simply calculated from the number of flues, chimneys, passive or intermittent fans in bathrooms and kitchens present in the dwelling.

Where a mechanical ventilation and heat recovery (MVHR) or exhaust air heat pump (EAHP) systems are included in the design then the calculation becomes more involved as the heat loss through ventilation is reduced but the energy used to run the systems are taken into consideration elsewhere in the calculation.

Particular care needs to be taken to correctly distinguish between a chimney and a flue. The former has a minimum aperture and is permanently open, whereas a flue has some form of restriction to it, either in dimensions or because it serves a non-room sealed boiler or a closed fronted solid fuel stove and these restrict air flow when the appliance is not in use.

Flues, chimneys, and fans are only included where they directly affect the air volume inside the insulated envelope. A flue to a non-room sealed boiler in an unheated garage or porch would not be counted.

Care is also needed where a heating appliance is inputted into a SAP10.2 software calculator directly from the UK Governments Boiler Efficiency Database: www.sedbuk.com/. The database includes both traditional open flue boilers (the flues for these require separate inclusion in the software calculation if they are located within the insulated envelope) and more modern room sealed appliances (the flues for these are ignored as they do not act on the heated volume).

If an appliance is chosen that has a fan assisted flue, the fan can be ignored as it neither acts on the volume inside the insulating envelope and the energy used by the fan is included within the overall boiler efficiency rating.

Air Infiltration

A building's air infiltration rate is measured in air changes per hour and is based on the permeability of the external envelope measured in $m^3/m^2/hr$ @50Pascals divided by 20. This is influenced by a number of factors:

- building geometry, the greater the surface of the buildings envelope relative to volume the greater the likely air infiltration rate
- the buildability of the building envelope
- the quality of construction

these can only be tested on completion, however the DER part of a SAP2012 compliance calculation allowed one of 2 options:

- a backstop air infiltration rate of $15m^3/m^2/hr$ @50Pascals, or
- a value which improves on the default subject to an air pressure test on completion.

The latest revisions to the Technical Standards and SAP10.2 remove the option to adopt a backstop value and requires all dwellings to be tested on completion.

The TER/TDER compliance calculations assume an air infiltration rate of $5m^3/m^2/hr$ @50Pascals. Approved Certifiers of Design must be wary of using very low air infiltration rate in a SAP compliance calculation which may be difficult to achieve when tested.

During testing windows and trickle vents are closed and all flues, chimneys and combustion air vents are blocked to ensure that only the infiltration through the fabric is measured.

Sheltered Effect

The presence of adjacent and adjoining buildings can shelter a dwelling and the number of sides which are sheltered is used to adjust the ventilation rate + infiltration rate to give the number of effective air changes per hour.

TER/TDER

The TER/TDER SAP10.2 compliance calculations assume no chimneys or flues, the same number of intermittent extract fans that match the extract points of the proposed dwelling, an air infiltration rate of $5m^3/m^2$ @50Pascals and the same number of sheltered sides as the proposed dwelling subject to a minimum of 2.

4A.8.3 Section 3 – Heat Losses and Heat Loss Parameter

Heat loss is defined as the flow of heat between systems that are not in thermal equilibrium with each other. Heat will spontaneously flow from the areas of high temperature to areas of low temperature.

The heat loss figures in this section are derived by using the internal surface areas of the insulated envelope that encloses the dwelling and their thermal resistances including thermal bridges.

Losses or gains through party floors to spaces in other dwellings or premises that are normally expected to be heated to the same extent and duration as the dwelling concerned are assumed to be zero (and these elements are therefore omitted from the calculation of heat losses).

Heat loss through party walls has been included to take account of the impact of air movement in cavities. The U-Value used in the DER/DDER calculations must be one of the three options available:

- solid or filled cavity party wall (0.0 W/m^2K), It is this value that is used in the TER/TDER or
- cavity party wall, where there is no cavity fill but cavity barriers restrict air movement (0.2 W/m^2K), or
- cavity party wall, where there is no cavity fill and no cavity barriers (0.5 W/m^2K).

The options for cavity walls apply irrespective of whether the cavity walls are formed from masonry, timber frames or a combination of the two.

A DER/DDER SAP10.2 compliance calculation allows for different types of elements where their U-values differ either by defining elements separately in the calculation or, where this is not possible, taking an area-weighted average U-Value. This includes reducing the effective U-Value of elements adjacent to an unheated space where there is a buffering effect. U-values should be adjusted for repeated thermal bridges such as timber studs in a timber framed wall.

The DER/DDER SAP10.2 compliance calculation also requires the impact of heat loss through non-repeating linear thermal bridges to be included. This is done by the inclusion of a Y-value which is calculated based on the sum of the lengths of all the thermal bridges multiplied by their respective Ψ-value divided by exposed building envelop. The previous option of using a default Y-value of 0.15 in SAP2009 without further calculation is no longer available (a Y-value of 0.05 is assumed in the TER/TDER calculations).

Individual Ψ-values are derived on a detail-by-detail basis from:

- Appendix K in SAP for domestic buildings, or Table 9 of the NCM Modelling Guide 2022 for non-domestic buildings, or
- calculations by a specialist based on the actual construction details, or
- where construction of a junction follows published and substantiated construction detail sets, input of Ψ-values of the relevant junction(s) can be taken from that document. This includes the Accredited Construction Details (Guidance) published by BSD, but this requires the source detailing to be replicated and/or referenced in the building warrant application and constructed on site.

Ψ-values can be mixed and matched, detail by detail within the overall Y-value calculation.

When multiplied by the length of each non-repeating linear thermal bridge (measured in meters) these values are aggregated to give a total additional heat loss measured in W/K which is added to the overall fabric heat loss. If this calculation is being undertaken within an approved SAP10.2 software program, care must be taken to ensure those values which pertain to Scotland are being used as some software

defaults to English practice. In general RIAS-regs recommends that an Approved Certifier undertake the calculation separately and enters their calculated Y-value, retaining a copy of their calculation within their certification logbook.

Heat Coefficient

The Heat Coefficient is the total of both the fabric heat loss from above and the impact of the effective air change rate on the building volume.

Heat Loss Parameter (HLP)

The heat loss is totalled as W/K and divided by the floor area to give the HLP in W/m^2K. The HLP is a measure of the overall fabric efficiency relative to the dwellings area. The HLP is used to set the mean internal temperature of the living room based on the heating type in Section 7 of SAP10.2 as well as the temperature difference between zones.

TER/TDER

The TER/TDER SAP10.2 compliance calculation is based on a set of U-values derived from the appropriate fuel package, a Y-value of 0.05 x the total exposed area of the dwelling envelope and an air infiltration rate of $5m^3/m^2/hr$ @50Pascals.

Thermal Mass

The Thermal mass parameter (TMP) is measured in kJ/m^2K is the sum of (area x heat capacity) of all the construction elements divided by the total floor area.

SAP10.2 allows this to be calculated or one of 3 indicative values to be used:

- low 100 kJ/m^2K, or
- medium 250 kJ/m^2K. It is this value that is used in the TER, or
- high 450 kJ/m^2K.

The inclusion of the TMP means that the Utilisation Factor (see 4A.8.6 - Section 6 below) can be adjusted to take account of thermal mass.

TER/TDER

The TER/TDER SAP10.2 compliance calculation matches the values entered in the DER/TDER calculations.

4A.8.4 Section 4 –Water Heating Energy Requirements

The total hot water demand is calculated in Appendix J, on a monthly basis, and is based on the number persons in the house, modified by the number of showers and baths, present, the flow rate of any showers and whether any wastewater heat recovery (WWHR) units are installed. The number of people is based on the floor area of the dwelling and is not necessarily an integer.

This total is reduced by 5% within the SAP2012 methodology where measures are in place to restrict the overall water demand to less than a total of 125 litres (hot and cold) per person per day, however, notwithstanding Section 7 of the Technical Standards there is currently no mechanism to evidence that this can be achieved by a specific design and should therefore not be used in Scotland by Approved Certifiers of Design.

The energy required and the $CO_{2(e)}$ emissions associated with the fuel used in providing the hot water demand are calculated monthly within SAP10.2 and take account of the:

- primary circuit losses (based on insulation and controls), and
- from any hot water cylinders or thermal stores, and
- boilers

These are offset by any contribution from solar hot water panels, flue gas heat recovery (FGHR) devices and wastewater heat recovery (WWHR) devices and are aggregated to give a total energy requirement from the water heater measured in kWh/year. Heat losses from the system are also taken into consideration in section 5 as a potential beneficial gain.

TER/TDER

The TER/TDER SAP10.2 compliance calculation follows the area calculation to assess the hot water requirement. If there is no HWC present in the proposal dwelling the TER/TDER follows suit. If there is, the TER/TDER assumes a hot water cylinder matching that proposed, subject to a minimum size of 150 litres, with a standing heat loss of 0.85 x (0.2 + 0.051 $V^{2/3}$) kWh/day, 'V' is the volume. It also assumes each shower has a WWHR unit fitted the efficiency of which varies between flats and houses.

The only exception to this is for new dwellings connected to a heat network, in which case it is assumed there is no HWC, WWHR nor heat losses from either a HWC, if present nor primary circuit losses.

4A.8.5 Section 5 – Internal Gains

Section 5 totals up potentially beneficial internal gains from the:

- lighting, appliances, cooking and metabolic rate of the occupants
- fans and pumps
- hot water system

TER/TDER

The TER/TDER SAP10.2 compliance calculations follow the DER/DDER SAP10.2 compliance calculations for section 5, other than a default assumption that 100% of fixed light fittings are low energy lights. Approved Certifiers of Design should take care in calculating the proportion of low energy lighting. Previous guidance in the Technical Standard required that lights and light fittings:

- inside stores are ignored
- below kitchen unit pelmets and inside cabinets are ignored
- above wash hand basins / mirrors etc are ignored
- in banks switched together are counted as one - Table 42 of the Domestic Building Services Compliance Guide now places a limit on the numbers
- lights to external areas, where they are powered through the dwellings electrical meter, are counted

Particular care should be taken not to confuse low voltage with low energy. The changes to the 2022 Building Standards requires that all lighting conforms to Section 13 of the Domestic Building Services Compliance Guide, making the calculation of the percentage of low energy lighting in a SAP compliance calculation moot, unless it is being used to demonstrate compliance for an extension or conversion, where some of the lighting may be existing.

4A.8.6 Section 6 – Solar Gains

Section 6 totals the solar gains through windows which are dependent on their size, orientation, over shadowing and specification of the windows.

SAP10.2 categorises openings as being windows, glazed doors or solid doors and Section 6.2 of the SAP10.2 document defines the minimum area of glazing for each definition. In particular patio doors with >70% glazed area, are treated as windows.

This section also adds in the Internal Gains from section 5 to give Overall Gains and divides them by the heat loss coefficient which is used to look up the Utilisation Factor. The Utilisation Factor shows what proportion of the overall heating requirement is offset by the Overall Gains.

TER/TDER

The TER/TDER SAP10.2 compliance calculation assumes all openings are fully glazed, orientated and areas totalling the same as the proposed dwelling, subject to a maximum of 25% of the dwelling floor area with a U-value of 1.2 and for glazed openings a Frame factor of 0.7, Solar energy transmittance of 0.63, and Light transmittance of 0.80 .

4A.8.7 Section 7 – Mean Internal Temperature

The mean internal temperature is calculated for two zones; the living room and rest of dwelling, based on the assumed heating pattern for a dwelling and the performance of the building fabric and services. It is calculated monthly. The mean internal temperature is adjusted to take account of internal and solar gains which are moderate by a utilisation factor.

4A.8.8 Section 8 - Space Heating Requirement

Section 8 calculates the temperature reduction which occurs when the heating is off and based on this, calculates the space heating requirement to increase the internal temperatures assumed in the heating regime. The space heating requirement is then adjusted to take account of internal and solar gains which are moderate by a utilisation factor.

The Space Heating Requirement is calculated monthly. It equals the Heat Transfer Coefficient x (mean internal temp – useful gains) / floor area. It is expressed in kWh/m^2/year.

4A.8.9 Section 8c - Space Cooling Requirement

Section 8c uses the same logic as Section 8, but for cooling loads. The Cooling Requirement is also calculated monthly and equals 0.024 x (mean external temperature for the month – useful gains) x days in the month / floor area. It is also expressed in Kwh/m^2/year.

4A.8.10 Section 8f - Fabric Energy Efficiency

The Fabric Energy Efficiency equals the Space Heating + Cooling Requirements.

4A.8.11 Section 9 - Energy Requirements

Section 9 totals up the energy requirements for heating, hot water, lighting, pumps & fans etc, factoring in the efficiency of each system to calculate energy as delivered and deducting any contributions from on-site renewable technologies.

4A.8.12 Section 10 – Fuel Costs

Section 10 multiples the energy delivered by each fuel type (from Section 9) by a cost per kWh to give an overall prediction of fuel costs for the dwelling.

4A.8.13 Section 11 – SAP Rating

Section 11 takes the overall fuel cost from section 10 and applies the Energy Cost Deflator and the Energy Cost Factor (ECF) which are set periodically by the UK Government, the resulting number is the SAP Rating (now expressed as the Energy Efficiency Rating on the EPC) and this is used to establish the EER (SAP) Band expressed as a letter between A-G.

4A.8.14 Section 12 – $CO_{2(e)}$ Emissions

Section 12 multiples the energy delivered by each fuel type (from Section 9) by their Emission Factor to produce the total amount of $CO_{2(e)}$ emissions per year per m^2 expressed as $CO_{2(e)}$kg/m^2.

Depending on which stream of the calculation you are looking at this may be the Environmental Impact Value, DER or TER.

The Environmental Impact Value is used to calculate the Environmental Impact (EI) Rating, expressed as a number and the EI Band expressed as a letter between A-G. Both are included on an EPC.

4A.8.12 Section 13 - Primary Energy

Section 13 takes the total energy delivered to the dwelling for each fuel and multiplies them by a Primary Factor to assess the total energy use of the dwelling expressed as both an overall total of kWh/yr and divided by the floor area to give kWh/yr/m^2. These figures are also included on an EPC.

4A.9 Simplified Approach

The previous Simplified Method is no longer available.

Module 4B

Calculation Methods for New Non-domestic Buildings

4B. MODULE 4B

Calculation Methods for New Non-domestic Buildings

4B.1 Introduction

This Module deals primarily with compliance with Standard 6.1 (Non-domestic) of the Building Standards which seeks to control the energy use of and $CO_{2(e)}$ emissions from new non-domestic buildings in use. In order to do this Standard 6.1 (Non-domestic) requires every new non-domestic building with a floor area ≥ 50m^2 to meet a Target Delivered Energy Rate (TDER) and for those whose heating is not by some form of electric heat pump a Target $CO_{2(e)}$ Emissions Rating (TER) remains in place.

The TDER and TER (where applicable) for each new non-domestic is set using the National Calculation Methodology adopted by the Scottish Government for the purpose of demonstrating the compliance of new non-domestic buildings with the building regulations. From the 1st February 2023, this is the Simplified Building Energy Model (SBEM v6.1) and a list of approved software can be found, by following the link at: https://www.uk-ncm.org.uk/page.jsp?id=37

It is a requirement of RIAS – Energy Design Certification that every Approved Certifier of Design (Section 6 – Energy) Non-domestic must be able to provide evidence that they have completed an approved course in the use of one or more current approved non-domestic software tools. In certifying the design of a new non-domestic building, the approved Certifier of Design will be restricted to using those approved tool(s) in which they have demonstrated competency.

Those applicants who cannot demonstrate a pre-existing competency must complete a suitable course such as the one provided by Strathclyde University: https://onlineshop.strath.ac.uk/product-catalogue/engineering-faculty/mechanical-aerospace-engineering/courses/riascibse-certifier-of-design-training As a result of this requirement for an external validation of an applicant's understanding and ability to use an approved tool this Module has a lighter touch compared with Module 4A.

Clause 6.1.1 (Non-domestic) provides two possible options either the use of the Simplified Building Energy Model (SBEM) which includes Scottish compliance parameters, or a dynamic simulation model. A

free basic version iSBEM is available at https://www.uk-ncm.org.uk/download.jsp A number of commercially available modelling tools incorporate the Simplified Building Energy Model (SBEM).

Alternatively other tools may be used such as dynamic simulation modelling (DSM) and these are particularly recommended where the building design is complex. Within the RIAS – Energy Design Certification Scheme such buildings would be considered as '*Advanced Buildings*' and approved Certifiers of Design are expected to be able to demonstrate specialist skills in order to certify these designs.

The guidance in this module is based on the use of iSBEM but the principles and procedures are applicable to other approved calculation tools.

A BDER/TDER and BER/TER (where applicable) compliance calculations compare the energy use, energy cost and $CO_{2(e)}$ emissions estimates for a proposed non-domestic building relative to those of a comparable notional building taking consideration of orientation, massing, fenestration, fabric and fixed building services performance.

4B.2 The Simplified Building Energy Model (SBEM)

The Energy Performance of Buildings Directive (EPBD) 2010/31/EU is a recast of Directive 2002/91/EC and requires member states to introduce standards to promote and improve energy efficiency in buildings. The EPBD has a number of strands. The first of which is the requirement for assessing energy use using consistent methodologies within member states. An annex to the EPBD defines a minimum of 8 factors that must be considered in any National Calculation Method (NCM):

1. Thermal performance of the building envelope
2. Heating and hot water systems
3. Air conditioning systems
4. Natural and mechanical ventilation
5. Artificial lighting
6. Climate and orientation
7. Passive solar systems and shading
8. Indoor climate

The NCM must also take into account the reduction in energy requirement from on-site renewable electricity generation, combined heat and power (CHP) systems, district heating and/or cooling systems and natural lighting.

The Simplified Building Energy Model (SBEM) is used to assess compliance of new non-domestic buildings and the process is described below as if using the iSBEM interface consisting of 5 stages as documented in iSBEM v6.1e User Guide downloadable from: https://www.uk-ncm.org.uk/download.jsp

1. the user divides a building into zones as described in paragraph 3.3 of the iSBEM User Guide, iSBEM then
2. Calculates for each heating period and each zone the energy needed to heat and/or cool them together with the energy required for hot water, lighting etc
3. Combines the results of those zones using the same systems and factors in system losses
4. Combines the results for all zones and systems to give delivered energy totals including building wide renewables
5. Converts these into energy requirements and $CO_{2(e)}$ emissions etc

Paragraph 3.3 of the iSBEM User Guides details how each storey of a building is zoned:

1. *Divide the floor into separate physical areas, bounded by physical boundaries, such as structural walls or other permanent elements*
2. *If any part of an area is served by a different HVAC or lighting system, create a separate area bounded by the extent of those services*
3. *If any part of an area has a different activity taking place in it, create a separate area for each activity*

4. *Attribute just one "activity" (selected from the drop-down list available for each building type) to each resulting area*
5. *Divide each resulting area into "zones", each receiving significantly different amounts of daylight, defining by boundaries which are:*
    - *At a distance of 6m from an external wall containing at least 20% glazing*
    - *At a distance of 1.5 x room height beyond the edge of an array of rooflights if the area of the rooflights is at least 10% of the floor area*
    - *If any resulting zone is less than 3m wide, absorb it within surrounding zones*
    - *If any resulting zones overlap, use your discretion to allocate the overlap to one or more of the zones*

This apparent simplicity belies the fact that SBEM involves calculations every bit as complex as a SAP Methodology as illustrated in Figures 1, 4 and 5, within the SBEM Technical Manual also available from: www.ncm.bre.co.uk/

Module 5

Other Section 6 Issues

5. MODULE 5

Other Section 6 - Energy Issues

5.1 Introduction

Modules 2, 3 and 4 derive their content mostly from, or make direct reference to, Standards 6.1 to 6.3 (Domestic and Non-domestic) and both the Domestic and Non-domestic Building Services Guides to which these Standards now refer.

The remaining Standards 6.4 to 6.10 (Domestic and Non-domestic) will be covered in this Module under the headings:

- 6.4 Insulation of Pipes, Ducts and Vessels
- 6.5 Artificial and Display Lighting
- 6.6 Mechanical Ventilation and Air Conditioning
- 6.7 Commissioning Building Services
- 6.8 Written Information
- 6.9 Energy Performance Certificates
- 6.10 Metering (metering does not apply to dwellings)

Standards 6.4 – 6.6 (Domestic and Non-domestic) impose requirements on the design and Standards 6.7 – 6.10 (Domestic and Non-domestic) impose requirements on the construction. In order to demonstrate compliance with these construction standards the building warrant application should outline the steps to be taken during construction, including the provision of information) to allow a Completion Certificate to be accepted by the local Authority.

Approved Certifiers of Design should be particularly mindful of these and ensure that the building warrant application includes appropriate references.

5.2 Insulation of Pipes, Ducts and Vessels

Standard 6.4 (Domestic and Non-domestic) applies to both new and existing buildings and states that all buildings "*must be designed and constructed in such a way that temperature loss from heated pipes, ducts and vessels, and temperature gain to cooled pipes and ducts is resisted"*.

The Domestic and Non-domestic Building Services Guides to which the Standard refers imposes an upper limit on the heat loss from a hot water vessel and refers in turn to BS 5422:2009 - Methods for specifying thermal insulating materials for pipes, tanks, vessels, ductwork and equipment operating within the temperature range -40°c to +700°c' and in the case of the Domestic Building Services Guide to BS 1566-1:2002+A1:2011 - Copper indirect cylinders for domestic purposes. Open vented copper cylinders. Requirements and test methods.

5.3 Artificial and Display Lighting

Standard 6.5 (Domestic and Non-domestic) states that "*every building must be designed and constructed in such a way that the artificial or display lighting installed is energy efficient and is capable of being controlled to achieve optimum energy efficiency"*.

A reduction in delivered energy, $CO_{2(e)}$ emissions, and running costs can be made by better use of natural daylight and limiting the use of artificial lighting.

Clause 6.5.1 (Domestic) refers to Section 13 of the Domestic Building Services Guide which defines the minimum efficiency of luminaires and the type of controls which together, constitute low energy lighting installations for both new and replacement systems within dwellings. Of these fixed light fittings only, the main light sources to a room are considered within a SAP compliance calculation. All other lighting such as:

- extremely low power fittings
- lighting within cupboards and store
- lights below pelmets in kitchens
- lighting above wash hand basins

are not included but are still covered by the Guide.

Clause 6.5.1 (Non-domestic) refers to the Non-domestic Building Services Guide, Section 12 of which, provides guidance on general interior and display lighting and control systems. Minimum standards are included in the Guide, which also offers the alternative of calculating the Lighting Energy Numerical Indicator (LENI) as alternative compliance methodology.

Clause 6.5.2 (Non-domestic) confirms that where installations are renewed the opportunity to improve performance should be taken and refers to Annex 6.C (Non-domestic).

5.4 Mechanical Ventilation and Air Conditioning

Standard 6.6 (Domestic and Non-domestic) requires that the form and fabric of every building minimises the need for mechanical ventilation and/or active cooling and that any systems that are installed are efficient and well controlled.

Guidance recognises that ventilation to buildings is of course required, especially in areas of high moisture build up or where unpleasant odours may be found, such as toilets, as well as to provide fresh air for occupants. Such ventilation can be provided by passive, active or mixed strategies.

The strategy, which is most efficient and appropriate for any particular building, will relate to other aspects of the building, such as its thermal mass, the air infiltration rate, the available fuel source, heating strategy and use.

Dwellings can vary from entirely passive ventilation systems to the more usual mixed strategy of natural ventilation with local extracts to kitchens and bathrooms, to mechanical vent heat recovery (MVHR) or exhaust air heat pump (EAHP) systems.

MVHR and EAHP systems aim to recover what heat might otherwise be lost through the extract system. Approved Certifiers of Design should be particularly mindful that SAP compliance calculations assume that these systems are electrically powered. Mains electricity has a particularly high energy cost (which might be offset by on site generation) compared to the fuel that may be saved in by not heating the air supply that has benefitted from heat recovery.

The design of such systems also brings to dwellings a level of complexity previously seen primarily in non-domestic buildings and Approved Certifiers of Design should ensure that the design of such systems has been undertaken by those competent to do so and that, particularly where new dwellings are concerned, they are accurately described in any calculations, that the overall performance of the systems are included in the building warrant application and that they are commissioned, tested and written information provided in line with the Standards.

Clauses 6.6.2 and 6.6.3 (Domestic) refers to Sections 10 and 11 of the Domestic Building Services Guide which defines minimum efficiencies of ventilation systems, air conditioning systems, controls and the requirements of ductwork design.

Standard 6.6 (Non-domestic) is more comprehensive as it covers the variety of non-domestic buildings from the relatively small-scale shop or office up to and including the complexity of a shopping mall or hospital. This range of complexity is recognised within RIAS-regs by the additional category of '*Advanced Buildings*' for which Approved Certifiers of Design must have demonstrated additional competencies.

In particular, this recognises the dividing line between small packaged systems, which come complete with a controls package and relatively short duct runs and complex mechanical ventilation and air conditioning (MVAC) systems which rely on a number of components being assembled on site and the efficiency of which is a function of the system design, components, assemble, commissioning and control.

Clause 6.6.1 (Non-domestic) recognises the part that building fabric, form, orientation, and thermal mass play in establishing internal conditions that may or may not need additional cooling for the intended use.

Clause 6.6.2 (Non-domestic) refers to the Non-domestic Building Services Guide which defines minimum efficiencies of ventilation, air conditioning systems and controls. Together with the requirement to minimise leakage in ductwork by following either:

DW 144 *Specification for sheet metal ductwork* (BESA, 2016), or

> BS EN 1507:2006 – 'Ventilation for buildings. Sheet metal air ducts with rectangular section. Requirements for strength and leakage'
> +
> BS EN 12237:2003 – 'Ventilation for buildings. Ductwork. Strength and leakage of circular sheet metal ducts' and
> +
> BS EN 13403:2003 – 'Ventilation for buildings. Non-metallic ducts. Ductwork made from insulation ductboards'

Clause 6.6.3 (Non-domestic) confirms that where installations are renewed the opportunity to improve performance should be taken and refers to Annex 6.C (Non-domestic).

5.5 Commissioning Building Services

Standard 6.7 (Domestic and Non-domestic) states that "e*very building must be designed and constructed in such way that energy supply systems and building services which use fuel or power for heating, lighting, ventilating and cooling the internal environment and heating the water, are commissioned to achieve optimum energy efficiency"*.

The Standard requires that the building services are in full working order, have been inspected and commissioned as per the manufacturer's instructions prior to completion.

The process of commissioning building services systems is part of the works and not part of the design, however the building warrant application must include a description of those services which are to be commissioned & tested and that these are to be undertaken by competent trades people with the requisite skills and knowledge.

Clause 6.7.1 (Domestic) is very short and refers to those systems typically found in a dwelling and refers to the guidance on inspection and commissioning in the Domestic Building Services Guide.

Clauses 6.7.1 - 6.7.4 (Non-domestic) include reference to CIBSE guidance, the testing of ductwork and the additional complexity of testing extended and altered ductwork systems.

This is particularly important where the performance of services must achieve a minimum threshold in order to demonstrate compliance and where the performance of these systems relies on a number of interactive components / construction elements, such as may have been covered by a Schedule 1. Or in the case of a non-domestic building move the design in to the *Advanced Building* category.

The information on the building warrant application (including a Schedule 1) allows the Local Authority Verifier to seek copies of relevant test certificates on completion, including where required a Form Q.

In certifying the design, the Approved Certifier of Design must ensure that the need for such information prior to completion, has been included in the building warrant application.

5.6 Written Information

Crucial to the energy efficient operation of any building is an understanding of the heating / cooling systems on the part of the occupiers and users. Standard 6.8 (Domestic and Non-domestic) states that "*the occupiers of a building must be provided with written information by the owner:*

> *(a) on the operation and maintenance of the building services and energy supply systems; and*
> *(b) where any air-conditioning system in the building is subject to regulation 17, stating a time-based interval for inspection of the system".*

The Standard requires that the owner of a building must provide the occupiers with written information to encourage them to optimise the energy performance in operation and maintenance of the heating, hot water services, ventilation systems and any decentralized equipment for power generation.

Whilst the actual information to be provided is part of the proposed works and therefore not required to be submitted with a building warrant application, the building warrant application should identify the specific information to be provided, i.e., a copy of the boiler manufacturers operating instructions etc.

Where alterations are being carried out to building services on a piecemeal basis, the alterations may not result in the optimum energy efficiency being attained for the whole system. In this case, a list of recommendations which would improve the overall energy efficiency of the system should be must be provided prior to completion. This requirement should be recorded in the building warrant application.

These allows the Local Authority Verifier to check that such instructions and recommendations have been provided on site at completion.

Clause 6.8.2 (Domestic) requires the provision of a '*Quick Start Guide*' an example is provided in Appendix 7.B. Clause 6.8.3 requires the provision of information that will enable the retrofit of zero direct emissions heating systems to be provided prior to completion.

Clause 6.8.0 (Non-domestic) refers to power plants that serve multiple buildings and the use of automatic monitoring and targeting (AM&T) systems. Clause 6.8.1 (Non-domestic) requires a Logbook to be provided prior to completion and cites CIBSE Technical Memorandum 31 (TM31), which provides guidance on the format and contents of a logbook. Clause 6.8.2 (Non-domestic) requires the provision of

information that will enable the retrofit of zero direct emissions heating systems to be provided prior to completion.

In certifying the design, the Approved Certifier of Design must ensure that the need for such information prior to completion, has been included in the building warrant application.

5.7 Energy Performance Certificates (EPCs)

It is important to remember that an EPC is not produced as part of the design or indeed the building warrant process. It is however a requirement of Standard 6.9 (Domestic and Non-domestic) for an EPC to be in place on any new building at the point of completion. Care must be taken not to confuse the output of a software compliance calculator with the legal status of an EPC. Much like an MOT certificate the actual paper copy of an EPC, which must be fixed to the building, is only a record of the document lodged with the Local Authorities Building Standards Register or with the Scottish EPC Register www.scottishepcregister.org.uk/

For the purposes of certification of design for new buildings an Approved Certifier of Design (Section 6 - Energy) must ensure that the design correctly identifies the method and placement of any EPC(s) that are required.

5.7.1 Domestic & Non-domestic EPCs

For those new dwellings completed on a building warrant registered by a Local Authority prior to 9th January 2013 it was sufficient for an Energy Performance Certificate to be provided in paper copy form only to the Local Authority for them to register in Section 1 of their Building Standards Register. For building warrant applications registered after this date EPCs must be lodged with the Scottish EPC Register by a member of an Approved Organisation.

5.7.2 Approved Organisations

Approved Certifiers of Design (Section 6 – Energy) who wish to lodge EPCs with the Scottish EPC Register, must become a Member of an Approved Organisation. RIAS-regs no longer operates as an Approved Organisation of a New Build Domestic Energy Assessment Scheme. A full list of those who do, can be found at: https://www.scottishepcregister.org.uk/assessorsearch

Approved Certifiers of Design (Domestic) can opt in, to the Scheme provided by Quidos, without further training and lodge EPCs for new domestic buildings. For details of the Quidos Scheme follow the link to: https://quidos.co.uk/ Quidos have agreed to waive their membership fee for the first 12 months of Membership, but Members should check that their choice of SAP software is supported by the Approved Organisation of their choice.

The Chartered Institute of Building Services Engineers (CIBSE) is recognised as an Approved Organisation which can approve New Build Non-domestic Energy Assessors and Approved Certifiers of Design (Section 6 - Energy) Non-domestic can opt in to that approval as long as they maintain their Approved Certifier of Design (Section 6 - Energy) Non-domestic status, a current subscription to RIAS-regs and meet those other criteria as set by CIBSE.
https://www.cibsecertification.co.uk/About-us/About-Energy-Certificates/Energy-Performance-Certificates

5.8 Metering

Standard 6.10 (Domestic and Non-domestic) does not presently apply to domestic buildings. It does require all new non-domestic buildings and those converted to a non-domestic use, to have separate meters for each occupancy. Clause 6.10.1 (Non-domestic) requires written information regarding location and familiarity to be provided. Clause 6.10.2 (Non-domestic) requires sub-metered of larger buildings in line with CIBSE TM39: Building Energy Metering (2009). Clause 6.10.3 (Non-domestic) extends the requirements of Standard 6.10 (Non-domestic) to existing buildings when altered to create multiple units in separate occupancy and/or when a heating system with a new fuel type is installed.

In certifying the design, the Approved Certifier of Design must ensure that the need for information under Clause 6.10.1 (Non-domestic) prior to completion, has been included in the building warrant application.

Module 6

Sections 0 - 5 and 7

6. MODULE 6

Sections 0-5 and 7

6.1 Introduction

The previous Modules primarily made reference to Section 6 - Energy of the Building Standards. This Module intends to illustrate that compliance with Section 6 - Energy must not compromise compliance with Sections 0 - 5 and Section 7.

Clause 0.1.10 (Domestic and Non-domestic) defines the role of Approved Certifiers of Design and places a particular responsibility on the Approved Certifier of Design to ensure that they have fully familiarised themselves with the design, as detailed in the building warrant application, that they are certifying. It is a requirement of membership of RIAS-regs that all Approved Certifiers of Design must be able to demonstrate that they have obtained a qualification in a construction related discipline and have minimum levels of experience in domestic and/or non-domestic construction. The Scheme therefore expects that each Approved Certifier of Design, regardless of whether they are fulfilling any other roles on a particular project, to have obtained, understood and retained sufficient information to be able to issue a Certificate of Design.

The Approved Certifier of Design must be particularly mindful of their overall role in the project and their relationship to other designers, the building warrant applicant and any agent that the applicant has chosen to use. A key tool for internal communication between the design team and for recording both the communication and the details of the design, as detailed in the building warrant application and certified is the Certification Checklist.

In many instances an Approved Certifier of Design will also be fulfilling the role of agent for the building warrant application, as such they have the responsibility of coordinating all the information required as

part of the application, which allows the Local Authority to both verify those sections of the regulations that are not certified and assess the works on completion.

In all but the simplest of projects it is likely that other designers and specialist contractors will have an input to the overall design and the Approved Certifier of Design must be mindful to request details of these designs where it can impact on compliance with Section 6 - Energy and to inform those designers and specialists of relevant information included within in any calculation or Schedule 1.

Where an Approved Certifier of Design is undertaking other design duties and potentially contract administration, this may be advantageous in ensuring the familiarity with the design, as detailed in the building warrant application which they are to certify. It must not however be seen as allowing a short cut in completing the certification process itself.

As soon as an Approved Certifier of Design identifies an issue where compliance with any part of Section 6 - Energy impacts on other sections or vice versa, the issue must be raised with the responsible designer and resolved to both the satisfaction of the designer and the Approved Certifier of Design.

Particular care should be taken when certifying compliance with Section 6 – Energy, when the primary author of the design is not the Approved Certifier of Design. In this instance the Approved Certifier of Design should make every effort to ensure that the primary author of the design is aware of the critical elements that ensure that the design is compliant and where, for instance, particular minimum performances (such U-values and airtightness values) have been relied upon, these must be documented in the building warrant application.

Section 6 - Energy should be read in conjunction with all the guidance in the Building Standards and supporting documents although particular attention should be given to Section 3 - Environment as it is here that there is the greatest interdependence.

6.2 Compliance

Sections 0 - 7 give guidance on how to achieve compliance with the building regulations. The eight sections each cover a number of related Standards. They are:

- Section 0 - General
- Section 1 - Structure
- Section 2 - Fire
- Section 3 - Environment
- Section 4 - Safety
- Section 5 - Noise
- Section 6 - Energy
- Section 7 - Sustainability

The following topics are covered and a summary of the points that illustrate compliance are noted:

- General
- Structures
- Fire
    - Choice of Materials
    - Heating Systems
    - Ventilation Systems
    - Cavity Barriers
- Environment
    - Facilities in buildings
    - Heating of buildings
    - Ventilation and cooling of buildings
    - Condensation
    - Natural lighting
    - Combustion air and cooling air for combustion appliances
    - Storage of woody biomass.

- Safety
- Noise
- Sustainability

In the case of alterations and extensions each of the Standards applies in so far that they relate to the element of work being undertaken. Similarly, all of the Standards must be complied with where they relate to a new building.

Approved Certifiers of Design should however be mindful that in the case of conversions Schedule 6 to Regulation 12 of the Building Standards divides the Standards into those which must be complied with in full, as if they were new buildings, and those which should be complied with as far as is "reasonably practicable" and in no case be worse than before the conversion. In this case the assessment of what is reasonable apropos Section 6 – Energy lies with the Approved Certifier of Design and the measures included in the building warrant application, must be viewed in relation to full compliance. Where full compliance is not possible the Approved Certifier of Design must record which Standards have not been fully complied with in the project checklist, together with the reasons for not achieving full compliance and any other measures that have been taken to ameliorate the shortfall.

6.3 Section 0 – General

In it is easy to overlook Section 0 - General as being discursive introductory text which once read can be safely skipped quickly past in looking for a specific answer to a narrowly defined question regarding compliance. This is a mistake as Section 0 - General provides guidance on the status of the Building Standards, which type of works are required to comply, which are required to comply and require a building warrant application, as well as generalised Standards requiring construction works to be fit for purpose and carried out to an acceptable standard of workmanship.

Approved Certifiers of Design must be mindful of those requirements in Section 6 - Energy, which seek to ensure that delivered energy use, and where applicable, $CO_{2(e)}$ emissions associated with the building in use are minimised. The requirements of Sections 3-5, to provide a comfortable, safe and quiet indoor environment and the absolute requirements of Sections 1 and 2 to ensure structural integrity and fire safety must not be compromised by the need to achieve compliance with Section 6 - Energy. This is particularly important when dealing with alterations and conversions of historic, listed or traditional buildings which are likely to fall short of what the current Building Standards require, but are at the same time of considerable cultural and historical importance.

In all cases an appreciation on the part of the applicant that the Building Standards can only be met where there is sufficient investment in both the design and construction phases of a project is required. While the Certifier of Design may well be able to offer their experience in terms of achieving an optimised design their role is not to aid the applicant in securing a building warrant for a compromised design. To do so is not only counter to the spirit of the Building Regulations but heightens the liability the Approved Certifier of Design has in certifying the compliance of a specific design.

6.4 Section 1 – Structures

The external envelope of a building not only has to provide a level of thermal insulation and limit air infiltration, but in the majority of buildings provides part of the primary structure of the building. Even in those instances where a separate internal structure takes the majority of the structural loads the external envelope must still be able to resist wind and snow loading and may be relied upon to provide racking resistance to an internal frame.

It is essential to fully understand the elements which go to making up the external envelope and liaise closely with the designer of those elements, particularly as the design of a new structure, or the alterations to an existing structure are currently the most likely elements of a building to be separately covered by a Certificate of Design for Section 1 – Structures.

Where unusual or particularly innovative structural designs are proposed, such as volumetric buildings, Structural Insulated Panels (SIPS), etc the Approved Certifier of Design must be particularly careful to ensure that the design is compliant and is not vulnerable to compromise during construction due to poor

site management (weather damage) or workmanship (seals missed out, insulation layers cut or chased for services).

Of specific significance, with regard to Section 6 - Energy is the proportion of thermal bridging in a structural element and the level of airtightness that can be achieved. This can vary as a result of supplier preferred details. Information on the required performance specification, prior to development of the detailed design, is therefore essential if it is to be accurately recorded in the building warrant application. Care should be taken to assess individual building details, as these may vary between locations, for example larger openings may have a different lintel arrangement, due to the span, and therefore different Ψ-values, compared to shorter spans.

Of particular significance to Section 1 - Structures are:

- the implications of running services through the building in a manner which does not impinge on its structural integrity. This is particularly important with the emergence of new technologies such as mechanical vent heat recovery (MVHR) systems that require reasonably large section ducts to run through a building
- the imposed and/or wind uplift loads from solar hot water panels, enlarged HW vessels, PV arrays and wind generators
- the requirement to provide wind posts, cripple studs etc at openings and within framed panels in order to carry wind, live and imposed loads that are not necessarily evident until the structural design is complete

Notwithstanding the design provided by a Structural Engineer or specialist supplier, consideration must also be given to those loose elements, such as dwangs, which are likely to be added during construction to provide fixings for radiators, sanitary ware etc.

Section 1 – Structures refers to the Structural Eurocodes as the primary source of structural design requirements in place of the previously referenced and now withdrawn British Standards. This is part of a transitional process from British Standards to Eurocodes. The earlier British Standards may still be used as an alternative reference (reversing the previous provision in the Building Standards which allowed the Structural Eurocodes to be used as an alternative to the British Standards), however care must be exercised. It is anticipated that future revisions of Section 1 - Structures will remove reference to British Standards entirely.

6.5 Section 2 – Fire

The performance of a building in the event of fire is of primary concern within any building regulatory process and specific consideration must be given to a number of areas:

6.5.1 Choice of materials

Materials perform differently in the event of fire and the performance of any insulating materials should be considered with regard to the risk of ignition, their location and exposure within a building as well as their effect on increasing the risk of the spread of fire and smoke both internally and externally and to other buildings.

Consideration should be given to the choice and position of materials and the effect on the spread of fire relative to boundaries, compartment walls and compartment floors, separating walls and separating floors.

- Standard 2.1 regulates the size of compartments within a building to reduce the fuel available to a fire
- Standard 2.2 regulates the requirement to provide fire resistance between areas of a building in different occupation, whether sharing party walls or floors
- Standard 2.3 regulates fire protection to structures
- Standard 2.4 regulates spread of fire and smoke within cavities
- Standard 2.5 regulates linings and materials on walls, ceilings, rooflights etc
- Standard 2.6 regulates spread of fire to neighbouring buildings

- Standard 2.7 regulates spread of fire on external walls, and
- Standard 2.8 regulates spread of fire from neighbouring buildings

All of these Standards may impose additional requirements on the performance of the building envelope which either restrict the choice of materials or could impact locally on the U-value or ψ-value of particular construction elements. Approved Certifiers of Design should take particular care to ensure that insulation materials are not introduced in a way that compromises these requirements, for example Clause 2.6.4 restricts the type of external insulation that may be used locally to the boundary, in certain circumstances preventing the use of certain high performance expanded or extruded insulation products in preference to alternative mineral based products.

6.5.2 Heating Systems

Consideration should be given to the proposed fuel type, the need for fuel storage/distribution and boiler/heating appliance locations. Specific choices carry with them a greater or lesser risk of being the source of ignition in a fire. There is also a natural link to Section 3 - Environment which includes Standards covering the safe installation and operation of heating systems and combustion appliances, the removal of combustion products and the construction of hearths, chimneys etc.

6.5.3 Ventilation Systems

In normal use ventilation systems are intended to carry away moist odorous air and potentially supply fresh air. Section 6 - Energy places a growing emphasis on heat loss through air infiltration and a consequence of reducing air infiltration is a move towards mechanical vent and heat recovery (MVHR) and Exhaust Air Heat Pump (EAHP) systems in dwellings and smaller non-domestic buildings which mirror the large complex systems more usually found only in larger complex non-domestic buildings.

Depending on the size and layout of a building an element of compartmentalisation may be required to demonstrate compliance with Section 2 - Fire and this should not be compromised by a ventilation system.

In the event of fire, ventilation routes can become pathways along which fire and smoke can spread. It is therefore essential that such systems are design with the eventuality of fire in mind. Clause 2.2.9 (Domestic) and 2.1.14 (Non-domestic) provide guidance on the measures which can be incorporated into the design of ventilation systems such as:

- enclosing ductwork in fire resisting enclosures
- the use of fire resisting ductwork
- the provision of fire dampers, particularly where ducts pass through compartment or separating walls

The provision of smoke detection systems within the ducting to activate either shut down or smoke control mode, in order to, inhibit the spread of fire and smoke may also have a role to play in more complex systems.

Ventilation ducts and other service openings such as pipework which penetrate a compartment or separating wall or a compartment or separating floor must be fire-stopped in accordance with Standards 2.1 and 2.2 (Domestic and Non-domestic).

6.5.4 Cavity Barriers

Cavity barriers are required to inhibit the spread of fire and smoke in unseen spaces in buildings such roof spaces and wall cavities, including from one cavity to another. In addition, cavity barriers may be necessary around penetrations through the building envelope such as windows and structural insulated panel systems. Consideration should be given, where cavity barriers are included, that their potential impact as non-repeat linear cold bridges has been including in any energy calculations, which accompany the building warrant application.

6.6 Section 3 - Environment

Section 3 covers the need to:

- Provide certain facilities within buildings to allow them to function autonomously
- Condition the internal spaces by providing heating (domestic only)
- Provide adequate ventilation for occupants, combustion and overheating
- Protect the built fabric from the impact of condensation etc
- Provide adequate levels of natural light
- Provide safe and operable combustion appliances
- Safely store heating fuels
- Promote water efficiency
- Overheating Risk

Each of these considerations has the potential to impact on the energy and $CO_{2(e)}$ emissions performance of the building.

6.6.1 Facilities in Dwellings

Standards 3.11 & 3.12 (Domestic) define those facilities that every dwelling requires such the provision of WCs and kitchens. Standard 3.13 (Domestic) requires a dwelling to be heated. Approved Certifiers of Design must take particular care to ensure that these facilities and the circulation routes to these facilities are considered as being within the insulated envelop. For example; where the requirement for an entrance level WC is accessed through what might at first seem an unheated space, it is recognised that to fulfil the requirement of Section 3 – Environment, that space must be conditioned to allow comfortable access.

Approved Certifiers of Design must also exercise care where conservatories or sunrooms are provided. Both must be thermally separated from the dwelling and cannot house those facilities, or be the only means of access to those facilities, without which the dwelling would be non-compliant with Section 3 - Environment.

In other words, it is not acceptable to define a kitchen in a dwelling as an unheated sunroom nor access a kitchen via a sunroom (if this is the only circulation route) unless the kitchen in question is additional to the minimum requirement of Clause 3.11.3 (Domestic).

6.6.2 Heating of Dwellings

Factors which contribute to the overall demand for space heating that a dwelling requires for any given pattern of use include:

- Layout,
- size and orientation of glazing,
- thermal mass,
- level of insulation / thermal bridging,
- airtightness, and
- ventilation

The starting point to achieving greater energy efficiency is to minimise this demand in both new dwellings and by improving, where possible, insulation levels etc in existing dwellings before then looking at the efficiency of the heating systems being provided.

In designing heating systems that are suitable for a particular dwelling consideration must also be given to the fuel types available, the implications for any fuel storage, the potential disposal of ash, the anticipated occupancy profile and the ability of the occupiers to manage the installed systems.

Similarly, consideration must be given to the impact of the heating system on the building fabric, for example; the installation of unflued individual gas fires may not only be unsuitable for dwellings intended

for the young and the vulnerable, but will also result in the release of moisture in to buildings which, if not adequately ventilated, will migrate out through the building fabric.

6.6.3 Ventilation of Dwellings

Standard 3.14 (Domestic) highlights the significant affect that ventilation has on the energy performance of dwellings. There is a significant overlap with Section 6 – Energy (Domestic) when assessing the appropriate ventilation strategy. Whether that is natural, with passive or intermittent extract, some form of whole house system, with or without heat recovery, or a combination of different systems.

Guidance highlights the benefits in reducing uncontrolled air infiltration in dwellings that will result in drafts and heat loss. However, where greater levels of air-tightness are achieved the ability to provide controlled ventilation must be increased to ensure adequate ventilation for occupation. Clause 3.14.0 (Domestic) recognises that ventilation is required to maintain air quality by reducing the impacts of $CO_{2(e)}$, water vapour and other toxins.

Clause 3.14.2 (Domestic) details the requirement for supply air, extraction and purge ventilation and how the ventilation strategy must respond to the demands placed upon it, by a dwellings built form and fabric attributes. The demands of a highly glazed dwelling with low thermal mass, will be entirely different to one with the opposite attributes.

Clause 3.14.5 and 10 (Domestic) requires a designated drying area to be ventilated, where this does not coincide with a space already ventilated, such as bathroom or utility room, approved Certifiers of Design must ensure that any additional ventilation system is included within any SAP compliance calculation.

Clause 3.14.5 and 6 (Domestic) address mechanical extract systems and where these are installed in dwellings which achieve high levels of airtightness the Clause 3.14.6 (Domestic) must be read closely with Clause 3.14.2 (Domestic) to ensure adequate supply ventilation is provided. In addition, care must be taken where heat recovery is included that these systems do not contribute inadvertently to summertime overheating.

Clause 3.14.28 (Domestic) has been added to take account of the need to prevent overheating. This replaces the previous requirement to assess overheating via Appendix P of SAP, in certain limited instances. Now the requirement is that every dwelling requires assessment. Whilst Approved Certifiers of Design (Section 6 – Energy) Domestic will not be certifying compliance with Clause 3.14.28 (Domestic) they are responsible under Clause 6.6.1 (Domestic) to ensure that the requirements of Clause 3.14.28 (Domestic) have been addressed adequately in the building warrant application.

6.6.4 Facilities in Non-domestic buildings

Standard 3.12 (Non-Domestic) defines those WC and (where appropriate) bathing facilities a non-domestic building requires depending on its use, to ensure that staff, residents and visitors have access where appropriate. Clause 3.12.13 (Non-domestic) also defines minimum sizes for a Changing Places Toilets (CPTs) where it has been chosen to provide these. Standard 3.13 (Non-domestic) which covers the requirement to provide heating to dwellings, does not apply to non-domestic buildings on the basis that not all non-domestic buildings require heating to some or all areas and that where heating is required, for particular activities, such as retail or office use, these are covered by other legislation such as the Health and Safety at Work Act 1974.

Where a building or part of a building is heated, Approved Certifiers of Design must take particular care to ensure that any WC or bathing facilities and the circulation routes to these facilities are considered as being within the insulated envelop. For example where a WC is provided to office accommodation that is subsidiary to an otherwise unheated non-domestic building and is then accessed through what might at first seem to be an unheated space (such as a lobby), it is recognised that to fulfil the requirement of Section 3 - Environment the space must be conditioned to allow comfortable access and therefore is considered to be within the insulated envelop of that portion of the building.

6.6.5 Heating of Non-domestic Buildings

Factors which contribute to the overall demand for space heating that a non-domestic building requires for any given pattern of use include:

- layout
- size and orientation of glazing
- thermal mass
- level of insulation / thermal bridging
- airtightness, and
- ventilation

The starting point to achieving greater energy efficiency is to minimise this demand in both new non-domestic buildings and by improving, where possible, insulation levels etc in existing non-domestic buildings before then looking at the type and efficiency of the heating systems being provided.

Particular non-domestic buildings may require specific environmental conditions to be maintained in some or all of the non-domestic building which will impose additional energy demands on the building services. For example the provision of a central IT system may give rise to a substantial internal heat gain, equally a frozen food packing plant requires to be maintained at very low temperatures in parts. Approved Certifiers of Design must remain mindful of distinguishing between the energy consumption of the non-domestic building itself, relative to the unregulated energy load associated with equipment and processes.

In designing heating systems that are suitable for a particular non-domestic building, consideration must also be given to the fuel types available, the implications for any fuel storage and disposal of ash, the anticipated occupancy profile, and the ability of the occupiers to manage the systems.

6.6.6 Ventilation and Cooling of Non-domestic Buildings

Standard 3.14 (Non-domestic) highlights the significant affect that ventilation has on the energy performance of non-domestic buildings. There is a significant overlap with Section 6 – Energy (Non-domestic) when assessing the appropriate ventilation strategy whether that is natural with passive or intermittent extract, some form of MVAC or HVAC system or a combination of different systems.

Guidance highlights the benefits in reducing uncontrolled air infiltration in non-domestic buildings that result in drafts and heat loss. However, where greater levels of airtightness are achieved the ability to provide controlled ventilation must be increased to ensure adequate ventilation for occupation. Clause 3.14.0 (Non-domestic) recognises that ventilation is required to maintain air quality by reducing the impacts of $CO_{2(e)}$, water vapour and other toxins.

Clause 3.14.2 (Non-domestic) details the requirement for trickle ventilation in naturally ventilated non-domestic buildings, including the requirement to adopt an alternative ventilation solution, where air-tightness levels are less than $5m^3/m^2/hr$ @50Pascals. Clause 3.14.2 (Non-domestic) also includes the requirement to provide ventilation to WC accommodation within a naturally ventilated non-domestic building, in accordance with Table 3.9 to Clause 3.14.5 (Non-domestic).

For non-domestic buildings with a designed air infiltration rate less than $5m^3/m^2/hr$ @50Pascals Clause 3.14.2 (Non-domestic) refers to the guidance provided in:

- Section 3 of BS 5925: 1991 (1995) or
- CIBSE Guide A: 1999, Design data, section A4, Air infiltration and natural ventilation or
- CIBSE AM10: Natural Ventilation in Non-Domestic Buildings (2005) Applications Manual AM10: 2005.

6.6.7 Natural Lighting

Standard 3.16 (Domestic and Non-domestic) only applies to dwellings and requires a minimum glazed area of $^1/_{15^{th}}$ of the floor area of each habitable room to ensure that adequate natural light is available to occupants. Care is needed where an existing opening is built over by an extension or a conservatory,

where the provision can be maintained by providing additional glazing to the new spaces, if the existing room would otherwise be compromised.

6.6.8 Combustion Appliances

Standards 3.17 – 3.22 (Domestic and Non-domestic) have been prepared with domestic scale installations in mind and include both space and water heating. For larger systems Clause 3.17.2 (Domestic and Non-domestic) refers to CIBSE guidance and the need for specialist design input.

Where a domestic project includes either new systems or substantial alterations to existing systems heated by:

- solid fuel appliances with an output rating more than 50kW, or
- oil-firing appliances with an output rating more than 45kW, or
- gas-fired appliances with a net input rating more than 70kW

it is most likely this will consist of multiple dwellings with a communal heating system. The Approved Certifier of Design must ensure that they have sufficient information to adequately reflect the system within their SAP compliance calculations and might consider the use of a Schedule 1 if the overall system relies on separate discrete components to be designed by a specialist later.

Where a non-domestic project includes either new systems or substantial alterations to existing systems heated by:

- solid fuel appliances with an output rating more than 50kW, or
- oil-firing appliances with an output rating more than 45kW, or
- gas-fired appliances with a net input rating more than 70kW

this would be considered to be an ‘Advanced Building’ and can only be certified by an Approved Certifier of Design who had demonstrated that they have attained the additional competencies to do so.

Standards 3.17 - 3.22 (Domestic and Non-domestic) focus on the safe installation and operation of combustion appliances and cover the:

- Installation
- Labelling
- Protection from combustion products
- Relationship to combustible materials
- Removal of products of combustion
- Air for combustion
- Air for cooling appliances

Approved Certifiers of Design must be mindful that any heating installation must not only be compliant with the Building Standards but be appropriate to the needs of the occupier and the restrictions imposed by the building design overall.

For example, Clause 3.21.5 provides guidance on the installation of flueless gas room heaters. By definition, such appliances do not require a flue nor is the additional ventilation required to support combustion considered in either SAP or SBEM compliance calculations.

Equally where a new dwelling relies on an air-tightness performance that is better than the default value of $15m^3/m^2/hr$ @50Pascals any ventilation provided for the purposes of combustion would be blocked during the test.

Taken together, this on paper makes flueless gas room heaters (with their high efficiency and responsiveness) potentially an attractive strategy for the main heating system, however Approved Certifiers of Design must consider this against the other impacts of such appliances with regard to safety from fire, carbon monoxide build up and condensation.

6.6.9 Storage and Fire protection of Fuels

Standard 3.23 (Domestic and Non-domestic) covers the requirements to protect any fuels (which by their nature are combustible) from fire and Standard 3.24 (Domestic and Non-domestic) covers the requirement for such storage that is provided, prevents spillage in the case of oil and is adequate in the case of woody Biomass.

The introduction of reliable, efficient and automated biomass boilers can help with the requirement to reduce $CO_{2(e)}$ emissions where that fuel comes from a sustainable and managed source. Such systems do however necessitate the consideration of the delivery and storage of the fuel, together with the safe disposal of ashes and the impact on air quality.

While Standards 3.23 and 3.24 (Domestic and Non-domestic) cover the appropriateness of any storage in terms of protecting the fuel from sources of ignition and both people and buildings from the impact of ignition they do not cover the convenience of use. For example; Approved Certifiers of Design should consider carefully whether individual biomass heating systems, such as a log burning stove, would be appropriate in a flatted development where fuel storage, while within the site covered by a building warrant application, is placed remotely from the dwelling if these are providing the primary heat source.

6.6.10 Water Efficiency

Standard 3.27 (Domestic) recognises that reducing water consumption reduces overall energy demand and emissions, from the processing and delivery of water to homes, as well as reducing energy consumption in the home to heat water. The Standard requires that consideration is given to all water using devices, but specifically limited the flow rates of taps and cistern volumes of WCs.

6.6.11 Overheating Risk

Standard 3.28 (Domestic and Non-domestic) relates to the potential for overheating in dwellings and other residential accommodation. The Standard introduces both a Simple Method and a Dynamic Thermal Analysis Modelling to assess overheating. The former is likely to be applied in the majority of cases. The assessment requires that that both the area of glazing and openable areas are assessed, which factor in both frame factors and g-values of openings and glazing. Car must be taken to ensure that the values used are consistent with those used in any SAP or SBEM compliance calculation.

6.7 Section 4 – Safety

Section 4 covers a wide range of safety, accessibility and ease of use issues which are aimed at ensuring that buildings can be used by persons to the best of their ability and that potential risks from hazards arising from the built form are avoided or minimised. Issues of importance for Approved Certifiers of Design include the following:

- Standards 4.1 - 4.3 (Domestic and Non-domestic) seek to ensure that, where reasonably practical, a barrier free access route is provided to and throughout buildings for the benefit of people with disability. Note that fixtures, such as radiators, should not obstruct circulation routes
- Standard 4.4 (Domestic and Non-domestic) seeks to safeguard people from accidental fall at an unguarded change of level in and around buildings, e.g. low-level window openings
- Standard 4.5 (Domestic and Non-domestic) seeks to ensure that any specification of fixed building services which operate at a voltage higher than extra low voltage do not present a risk of fire or injury from electric shock
- Standard 4.6 (Domestic) requires a suitable provision of electric lighting within dwellings and any associated common area. It does not apply to non-domestic buildings
- Standard 4.8 (Domestic and Non-domestic) In considering the size, form and specification of glazing to deliver thermal benefits (such as solar gain), be aware of requirements under this Standard on danger from projections (such as open windows), the need to address safe cleaning and collision with glazing and consider the location and positioning of controls to building services to allow safe and easy access and use
- Standard 4.9 (Domestic and Non-domestic) seeks to protect people in and around buildings from the from the danger of severe burns or scalds from the discharge of steam or hot water

- Standard 4.11 (Domestic and Non-domestic) seeks to ensure that suitable fire protection measures are taken for a liquefied petroleum gas storage installation, depending on its type, size, and location.

6.8 Section 5 - Noise

Section 5 requires the provision of sound insulation, to minimise the transmission of noise from buildings adjoining dwellings (including other dwellings) and non-domestic buildings containing residential accommodation. In addition, it covers the provision of sound insulation around sleeping accomodation to minimise the transmission of noise from surrounding habitable rooms.

Care must be taken in designing any areas of building construction that form part of a separating or internal wall or floor to ensure that they achieve the required level of noise reduction. The introduction within SAP compliance calculations of a U-value for party walls (to take account of the thermal bypass associated with air movement in a cavity) means that cavities in party walls are now routinely filled to exclude air movement. This must not compromise the level of noise separation required.

Along with direct sound transmission through the building fabric careful detailing is required to prevent paths for flanking sound at junctions between party walls, party floors and other construction elements where sound can penetrate. Care must be taken that such detailing is considered in any ψ-value calculations and adequately reflected in any SAP or SBEM compliance calculations.

Standard 5.2 (Domestic and Non-domestic) limits the transmission of noise between rooms. Approved Certifiers of Design should be mindful of the impact of ducts to ventilation and MVHR systems which pass through internal walls that are required to achieve a minimum level of noise separation.

All the Standards in Section 5 are listed in Schedule 6 to Regulation 12 as Standards that conversions must comply with, as if they are new buildings, whereas Standards 6.2 – 6.6 (Domestic and Non-domestic) are only to be complied with in so far as is "*reasonably practical*". This means that in determining whether existing construction elements are fit for purpose, either with or without enhancement, the post conversion performance relative to Section 5 takes precedence over Standards 6.2 – 6.6 (Domestic and Non-domestic).

6.9 Section 7 - Sustainability

Section 7 covers Aspects 1 - 8 where the performance of new dwellings and schools can be recognised as going beyond that of the minimum level of compliance required to be achieved by the design described in the building warrant application. In addition, all other new non-domestic buildings can be recognised as achieving an enhances Aspect 1 performance.

Clause 7.1.0 (Domestic and Non-domestic) requires a Statement of sustainability, commonly referred to as a Sustainability Label, to be fixed to new buildings prior to acceptance of a Completion certificate, which records the overall performance of the building.

Individual Aspects can be rated as 'Bronze', 'Silver', 'Gold'. Compliance with the Building Standards is recognised as achieving 'Bronze' in Aspects 2-8. Aspect 1 relates to $CO_{2(e)}$ emissions and achieving the requirements of Standard 6.1 (Domestic and Non-domestic) is now recognised as achieving 'Gold'. However, Aspect 1 includes a 'Platinum' level where new buildings have zero or negative $CO_{2(e)}$ emissions.

Of the eight Sustainability Aspects 1-3 all having a bearing on the energy performance and $CO_{2(e)}$ emissions of the new building the in use. To be fully awarded either the enhanced level silver or gold all 8 aspects must be achieved. In addition, both "Bronze" and "Silver" can be further awarded with an "Active" accreditation where Low or Zero Carbon Generating Technologies (LZCGT) are incorporate.

In order to substantiate a performance aspect beyond Bronze Aspect 2 and 3 requires a SAP or SBEM compliance calculation and Approved Certifiers of Design may be called upon to undertake these. This is particularly important where these levels of enhanced performance rely on new and innovative systems, which may include a number of components and construction elements working in combination. In these instances, where a specialist contractor may be relied upon to design and install such systems a Schedule 1 should be included alongside the Certificate of Design.

Sustainability Labels are generated using the Building Standards Division's on-line generator which can be found at: https://www.s7sust.co.uk/

The Scheme website provides further information at www.rias-regs.co.uk

Enquiries about the Scheme may be answered at the RIAS – Energy Design Certification website. Otherwise, enquiries should be addressed to:

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