Building Regulations Part L

IBCI Conference April 2014

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- Part L Overview
- DEAP & BER
- Case Study
- Future

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Part L Overview

Part L - Conservation Of Fuel & Energy

TGD L Dwellings 2011

- New Dwellings
  - EPC, CPC
  - Renewable Energy
  - U Values (backstop)
    - ✓BBA Research U Values
  - Thermal Bridging
  - Acceptable Construction Details
  - Air Tightness (ventilation)
  - Services, controls
  - Boiler Efficiency
  - User Information
- DEAP & BER
- Existing Dwellings

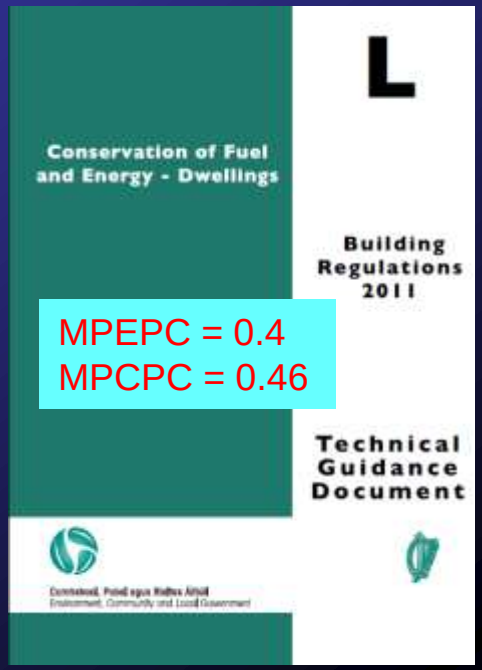
TGD L Buildings 2008

- U Values (backstop)
- Thermal Bridging
- Services, controls
- Solar Overheating

Acknowledgements:
DECLG, DCENR, SEAI, CIT, NSAI, BBA, BRE & NHBC Foundation.

Part L Overview

60% improvement on 2005 Part L

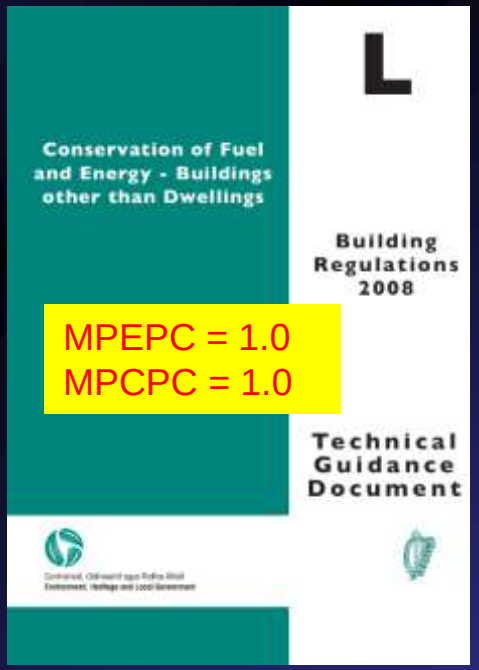


MPEPC = 0.4
MPCPC = 0.46

NEW DWELLINGS

Renewal energy
10 kWh/m^2/yr thermal
or 4 kWh/m^2/yr electrical
or combination

Air Tightness
q50 = 7 m^3/(hr.m^2)



MPEPC = 1.0
MPCPC = 1.0

Artificial Lighting
CIBSE "Code for Lighting"

Solar Overheating
Daily load <= 25 W/m^2

TGD L 2008 MPEPC 0.6, MPCPC 0.69

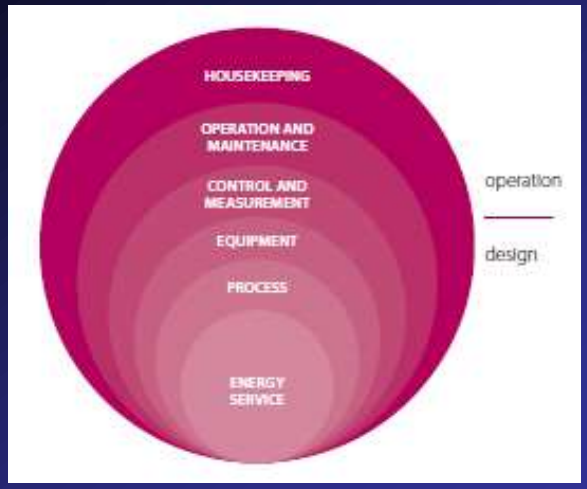
Work commenced by 30 November 2011
Substantial completion by 30 November 2013

Work commenced by 30 June 2008
Substantial completion by 30 June 2010

Essential References

- Other Codes / Standards / Software

References in TGD L: Available on www.environ.ie, www.seai.ie or purchase from NSAI or BSI



Regulation L1

L1 A building shall be designed and constructed so as to ensure that the energy performance of the building is such as to limit the amount of energy required for the operation of the building and the amount of carbon dioxide (CO_2) emissions associated with this energy use insofar as is reasonably practicable.

Design & Construct the building

LIMIT

1.Amount of Energy Required (EPC)

2.Amount of CO_2 emissions (CPC)

for the operation of the dwelling

Regulation L2

L1 A building shall be designed and constructed so as to ensure that the energy performance of the building is such as to limit the amount of energy required for the operation of the building and the amount of carbon dioxide (CO_2) emissions associated with this energy use insofar as is reasonably practicable.

L2 For existing dwellings, the requirements of L1 shall be met by: -

(a) limiting heat loss and, where appropriate, maximising heat gain through the fabric of the building;

(b) controlling, as appropriate, the output of the space heating and hot water systems;

(c) limiting the heat loss from pipes, ducts and vessels used for the transport or storage of heated water or air;

(d) providing that all oil and gas fired boilers installed as replacements in existing dwellings shall meet a minimum seasonal efficiency of 90% where practicable.

Regulation L2

Guidance relates to fabric heat loss by way of

- Material Alteration
- Extension
- Material Change of Use from building to dwelling

3 main issues

- Fabric Insulation
- Thermal Bridging – for Extensions adopt ACDs
- Limitation of Air Permeability – for Extensions adopt ACDs or equivalent alternative approach

SR 54 Code of Practice for the energy efficient retrofit of dwellings

(Published 7 March 2014 – 281 no. pages)

Contents

- Building Science
- Planning a retrofit
- Roofs
- Walls
- Opening
- Floors
- Ventilation
- Heating & hot water systems
- Residential Lighting
- Annexes A - H

Appendices

Annex A – U Values & Tables - Roofs

Annex B – U Values & Tables - Walls

Annex C – U Values & Tables - Floors

Annex D – Driven Rain Index

Annex E – Boiler Interlock

Annex F – Project Management

Annex G – Thermal Bridging

Annex H – Thermal Bridging Details

Regulation L3: New Dwellings

L3 For new dwellings, the requirements of L1 shall be met by: -

(a) providing that the energy performance of the dwelling is such as to limit the calculated primary energy consumption and related carbon dioxide (CO_2) emissions insofar as is reasonably practicable, when both energy consumption and carbon dioxide (CO_2) emissions are calculated using the Dwelling Energy Assessment Procedure (DEAP) published by Sustainable Energy Authority of Ireland;

(b) providing that, for new dwellings, a reasonable proportion of the energy consumption to meet the energy performance of a dwelling is provided by renewable energy sources;

(c) limiting heat loss and, where appropriate, availing of heat gain through the fabric of the building;

(d) providing and commissioning energy efficient space and water heating systems with efficient heat sources and effective controls;

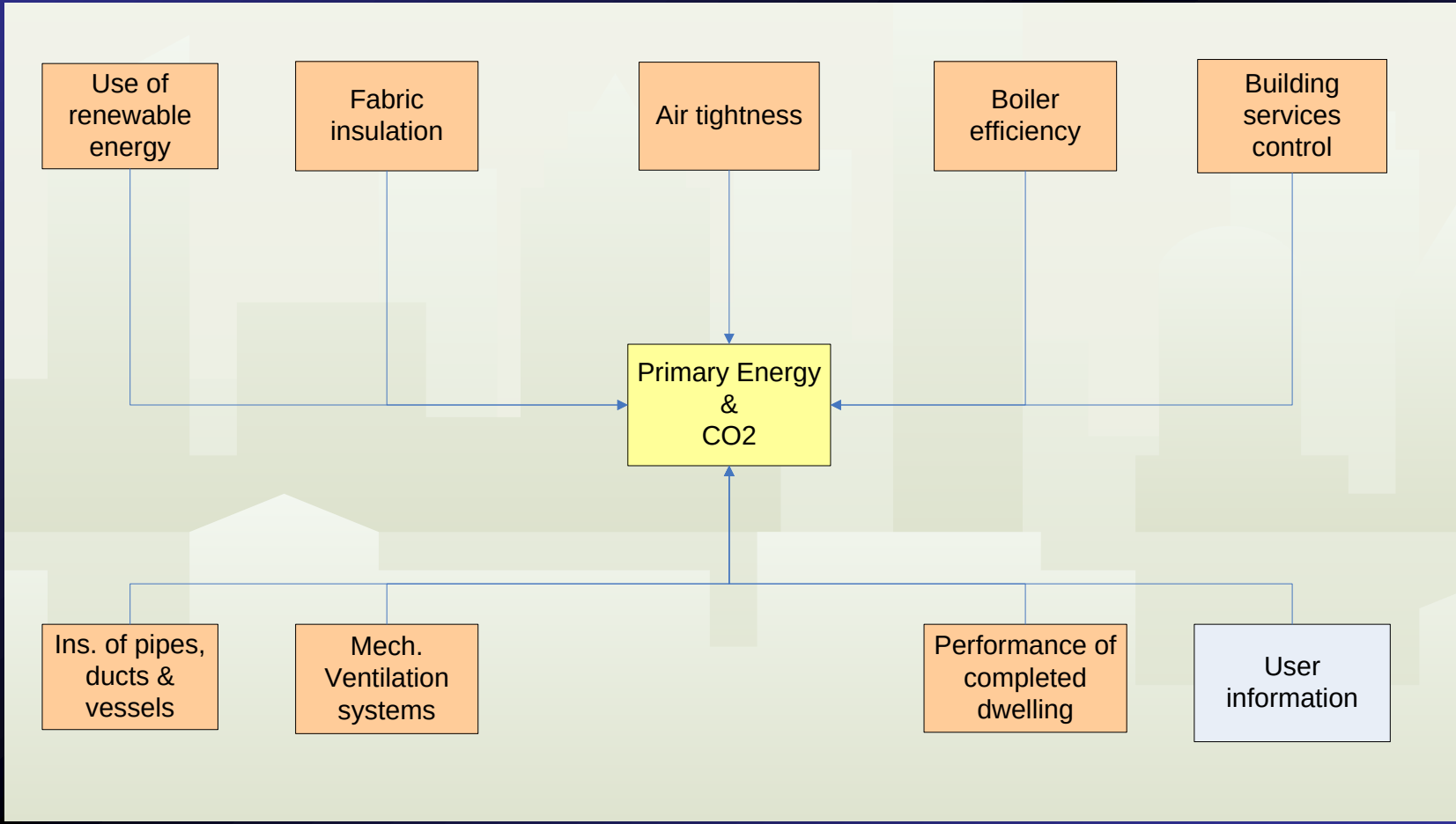
(e) providing that all oil and gas fired boilers shall meet a minimum seasonal efficiency of 90%;

(f) providing to the dwelling owner sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and energy than is reasonable.

General Guidance

TGD L 2011 @ Page 6

Minimum performance levels for each of the following



TGD L Buildings other than Dwellings 2008

L4 For buildings other than dwellings, the requirements of L1 shall be met by:

(a) providing that the energy performance of the new building is such as to limit the calculated primary energy consumption and related CO_2 emissions insofar as is reasonably practicable, when both energy consumption and CO_2 emissions are calculated using the Non-domestic Energy Assessment Procedure (NEAP) published by Sustainable Energy Ireland;

(b) limiting the heat loss and, where appropriate, maximising the heat gains through the fabric of the building;

(c) providing energy efficient space and water heating services including adequate control of these services;

(d) ensuring that the building is appropriately designed to limit need for cooling and, where air-conditioning or mechanical ventilation is installed, that installed systems are energy efficient, appropriately sized and adequately controlled;

(e) limiting the heat loss from pipes, ducts and vessels used for the transport or storage of heated water or air;

(f) limiting the heat gains by chilled water and refrigerant vessels, and by pipes and ducts that serve air conditioning systems;

(g) providing energy efficient artificial lighting systems (other than emergency lighting, display lighting or specialist process lighting) and adequate control of these systems.

TGD L Buildings other than Dwellings 2008

Refer also to

TGD M 2010

Lighting requirements

TGD B 2006

Lighting of Escape Routes

Table 5 **Light sources suitable for general lighting**

Light source	Types and rating
High pressure Sodium	All types and ratings
Metal halide	All types and ratings
Induction lighting	All types and ratings
Tubular fluorescent	26 mm diameter (T8) lamps, and 16 mm diameter (T5) lamps rated above 11W, provided with high efficiency control gear. 38 mm diameter (T12) linear fluorescent lamps 2400 mm in length
Compact fluorescent	All ratings above 11W
Other	Any type and rating with an efficacy greater than 50 lumens per circuit Watt.

TGD L Buildings other than Dwellings 2008

Understanding overheating – where to start:

An introduction for house builders and designers

Overheating in new homes

A review of the evidence

Available form the NHBC Foundation Website.

www.nhbcfoundation.org **NF44 & NF 46**

NHBC Foundation = NHBC + BRE Trust

Renewable Energy Technologies

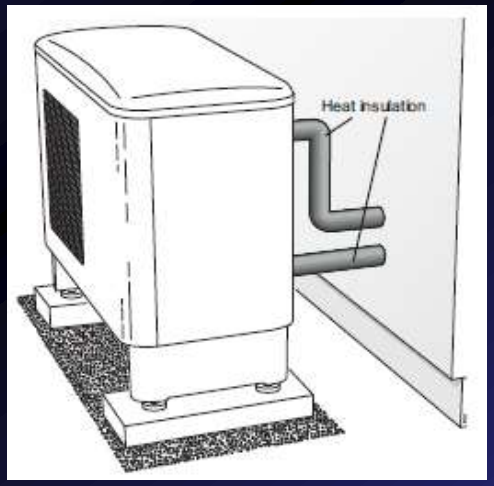
TGD L 2011 @ 1.2.1 Page 14

- Each dwelling should have a minimum level of energy provision from renewable energy technologies equivalent to
  - 10 kWh/m^2/annum of thermal energy, or
  - 4 kWh/m^2/annum of electrical energy, or
  - A combination of these which would have equivalent effect

Heat Pumps

Operational considerations

- Technology proven
- High front end cost
- Operational and maintenance costs
- Lower water content & lower water operating temperature systems are most efficient



Type		F2026-6		F2026-8		F2026-10	
Sound power level, according to EN12102 at 7/45	Lw(A)	57		57/62		57/62	
Fan speed		**Low**	**High**	**Low**	**High**	**Low**	**High**
Max sound pressure level at 2 m*	dB(A)	54	54	54	59	54	59
Max sound pressure level at 6 m*	dB(A)	33.5	33.5	33.5	38.5	33.5	38.5
Max sound pressure level at 10 m*	dB(A)	29	29	29	34	29	34

NOTE

It is important to the heat pump function that condensation water is led away and that the drain for the condensation water run off is not positioned so that it may cause damage to the house.

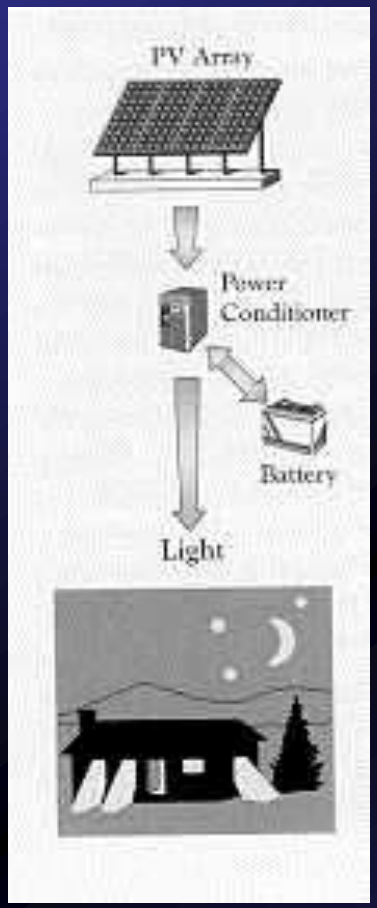
Solar Panels - Space Heating

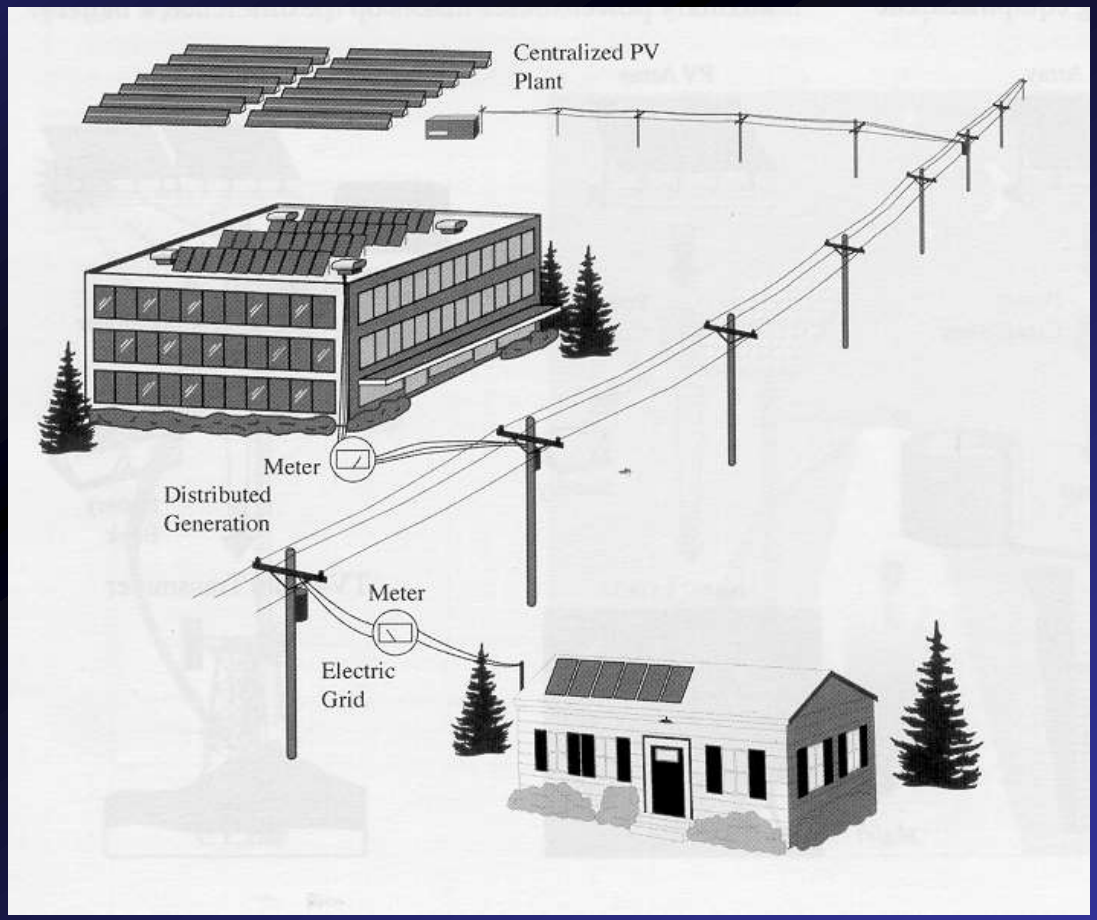
- Needs large surface area of solar collectors
- Large buffer storage required
- Under-floor heating or low temperature radiators ideally
- Must have alternative heating system as back-up

SR 50 Code of Practice for Building Services - Part 2 – Solar Panels

Photovoltaic (PV)

Direct conversion of sunlight to electricity





RENEWABLE TECHNOLOGIES

Further Reading

Available form

NHBC Foundation,

SEAI

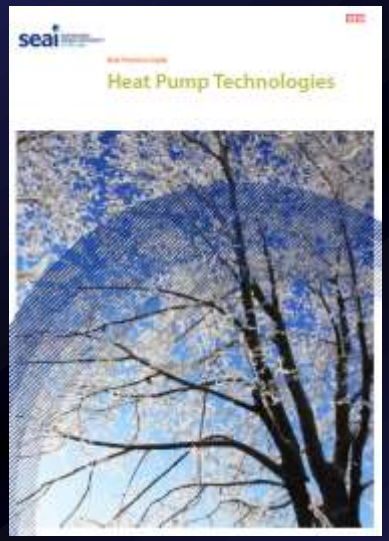
Advice on

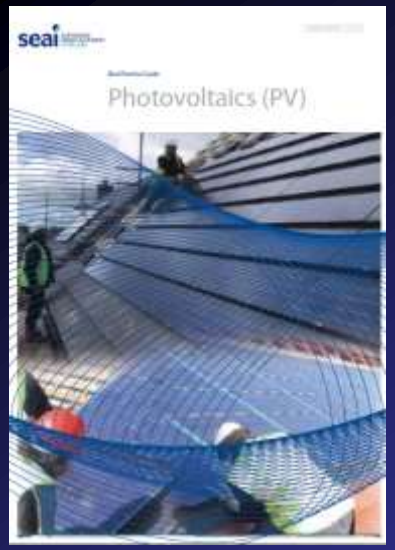
Heat Pumps

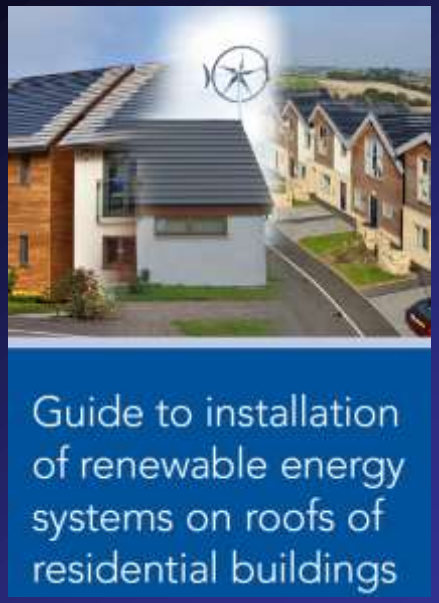
PV systems

Solar thermal systems

Micro wind turbines







Appendix A - U Values

Table 1	Maximum elemental U-value (W/m^2K)[1, 2]	
Column 1 Fabric Elements	**Column 2 Area-weighted Average Elemental U-Value (Um)**	**Column 3 Average Elemental U-value – individual element or section of element**
Roofs		
Pitched roof		
- Insulation at ceiling	0.16	0.3
- Insulation on slope	0.16	
Flat roof	0.20	
Walls	0.21	0.6
Ground floors[3]	0.21	0.6
Other exposed floors	0.21	0.6
External doors, windows and rooflights	1.6[4]	3.0

Notes:

1. *The U-value includes the effect of unheated vo spaces.*
2. *For alternative method of showing compliance paragraph 1.3.2.3.*
3. *For insulation of ground floors and exposed flo incorporating underfloor heating, see paragrap*
4. *Windows, doors and rooflights should have a maximum U-value of 1.6 W/m²K when their combined area is 25% of floor area. However areas and U-values may be varied as set out in Table 2.*

Table 2	Permitted variation in combined areas (A_{ope}) and average U-values (U_{ope}) of external doors, windows and rooflights
Average U-value of windows, doors and rooflights (U_{ope}) (W/m^2K)	Maximum combined area of external doors, windows and rooflights (A_{ope}), expressed as % of floor area (A_f)
0.8	58.9
1.0	44.8
1.2	35.1
1.3	31.9
1.4	29.2
1.5	26.9
1.6	**25.0**
1.7	23.3
1.8	21.9
1.9	20.6
2.0	19.4
2.2	17.5
2.4	15.9
2.6	14.5

ate values of "combined areas" or of "U-values" may ted by interpolation in the above Table.
ely the following expression may be used to the appropriate value:

$A_{ope} / A_f = 0.3475 / (U_{ope} - 0.21)$

This expression may also be used to calculate appropriate values outside the range covered by the Table.

Backstop Values

Fabric Insulation

Phenolic foam in partial fill cavity wall , Lambda value 0.020 W/mK

100/110	U value
60mm	0.28

120/130	U value
80mm	0.22

140/150	U value
100mm	0.18

+

Phenolic foam insulated plasterboard fixed directly to inside

	U value
37.5mm	0.191
52.5mm	0.167
62.5mm	0.152

	U value
37.5mm	0.161
52.5mm	0.143
62.5mm	0.132

	U value
37.5mm	0.137
52.5mm	0.125
62.5mm	0.116

Appendix B – Fabric Insulation

Additional guidance for common constructions TGD L 2011 - Page 43

General

B1. Guidance is not exhaustive & you are referred to **BR 262:2001 Thermal Insulation: Avoiding Risks** along with other relevant sources of guidance.

Also refers to **Limiting Thermal Bridging and Air filtration – Acceptable Construction Details.**

B2. U value will vary depending on conductivity i.e. Higher performing insulating materials can achieve any given U value with a lower thickness of insulating material.

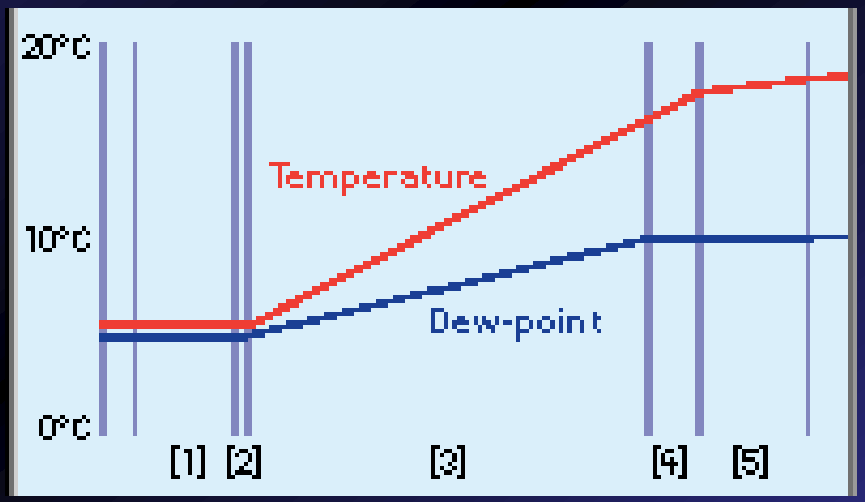
Appendix B – Fabric Insulation

Additional guidance for common constructions TGD L 2011 - Page 43

B3. Use I.S EN ISO 13788 to assess the risk of

- Surface condensation & Mould Growth
- Interstitial Condensation

Outside



Inside

I.S. EN 15026 can also be used to assess the risk of

- Surface Condensation & Mould Growth

Appendix B – Fabric Insulation

Additional guidance for common constructions TGD L 2011 - Page 43

B4. VCL reduces the water vapour transfer through any building component.

- Place on warm side of insulation.
- Seal to adjoining elements e.g. Glazing, Masonry upstands and any VCL in those elements.
- Seal around all service penetrations.
- 50mm minimum laps, sealed and have solid backing.
- Polythene sheeting where used should be protected from heat & sunlight to reduce risk of degradation.
- Foil back plasterboard joints should be sealed & allow for thermal movement

Appendix B – Fabric Insulation

Additional guidance for common constructions TGD L 2011 - Page 44

B5. Roof Constructions

- Provision of adequate roofspace ventilation
- Minimise transfer of water vapour from occupied dwelling are to cold attic space
- Minimise the extent of cold bridging – ACDs
- Protect water tanks & pipework against risk of freezing
- Overheating of electric cables or fittings
- Access to tanks, services & fittings in roofspace

❖ Types R1 – R5

Appendix B – Fabric Insulation

Additional guidance for common constructions TGD L 2011 - Page 48

B6. Wall Constructions

- Condensation
- Thermal bridging - ACDs
- Junctions with solid party walls & partitions
- Junctions with intermediate floors
- Stairs, cupboards & other fittings supported on or abutting the external wall – continuity of insulation
- Ducts against external walls – continuity of insulation, ingress of cold external air

❖ Types W1 – W4

Appendix B – Fabric Insulation

Additional guidance for common constructions TGD L 2011 - Page 52

B7. Floor Constructions

- Ground conductivity should be taken as 2.0 W/mK
- Insulation may be placed above or below DPM (should perform well under prolonged damp conditions)
- Taping of joints between insulation boards
- Fractional area of timber joists 11%
- Minimise air circulation in suspended timber floors
- Thermal bridging at wall/floor junctions - ACDs

❖ Types F1 – F5

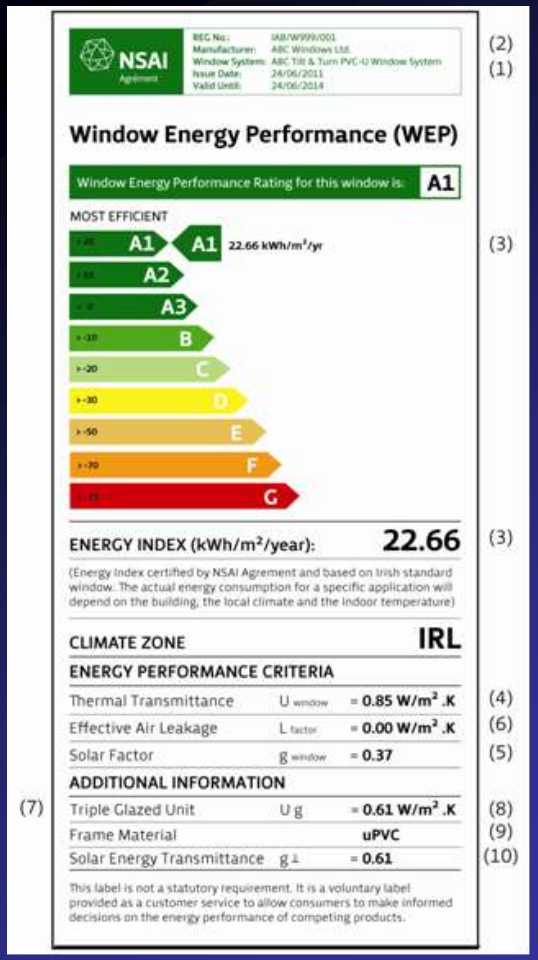
Appendix B – Fabric Insulation

Additional guidance for common constructions TGD L 2011 - Page 56

B8. Windows & Doors

- Table B1 – indicative U-values (W/m²K)
- Annex F I.S. EN ISO 10077-1
- Window Energy Performance Certification Scheme (WEP) or equivalent.
- DEAP Manual

WEP Certificates available on www.nsai.ie



Cavity Fill Insulation

Rendered Walls – Everywhere

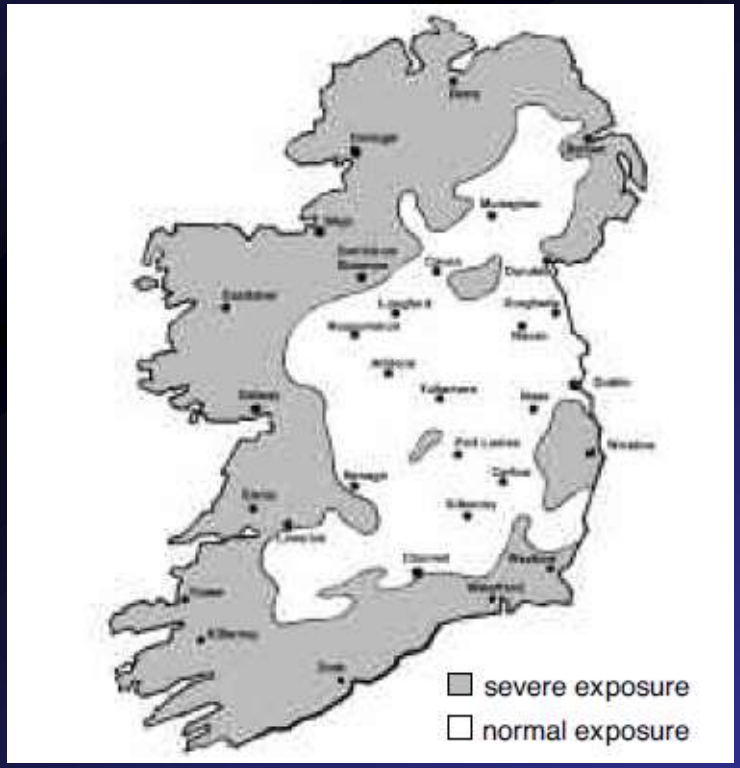
- 12m height 90mm Cavity

Brickwork – Only Normal Exposure

- 2 storeys 90mm Cavity
- 3 storeys 140mm Cavity

Un rendered blockwork – Never

Timber Frame - Never



Cavity Fill insulation must be appropriately certified in relation to its intended use and conditions of use.

See guidance in independent certificate in relation to topography & influence on wind driven rain and other conditions.

Appendix C – EPC, CPC

Reference values for calculation MPEPC & MPCPC

TGD L 2011 - Page 59

Table C1 – notional reference dwelling

- Total external window, rooflight and door area is taken to be 25% of the dwelling floor area
- Primary heating system for space & water heating is gas
- Secondary heating system is open fire – contributes 10% to space heating
- Walls: U = 0.27 W/m^{2}K, Roof: U = 0.16 W/m^{2}K
- Floor: U = 0.25 W/m^{2}K, Windows/doors: U = 2.2 W/m^{2}K
- Hot water cylinder: 120L, 35mm factory applied foam
- Programmer + room thermostat + TRVs, boiler interlock

Appendix D – Thermal bridging

Thermal bridging at junctions and around openings TGD L 2011 - Page 61

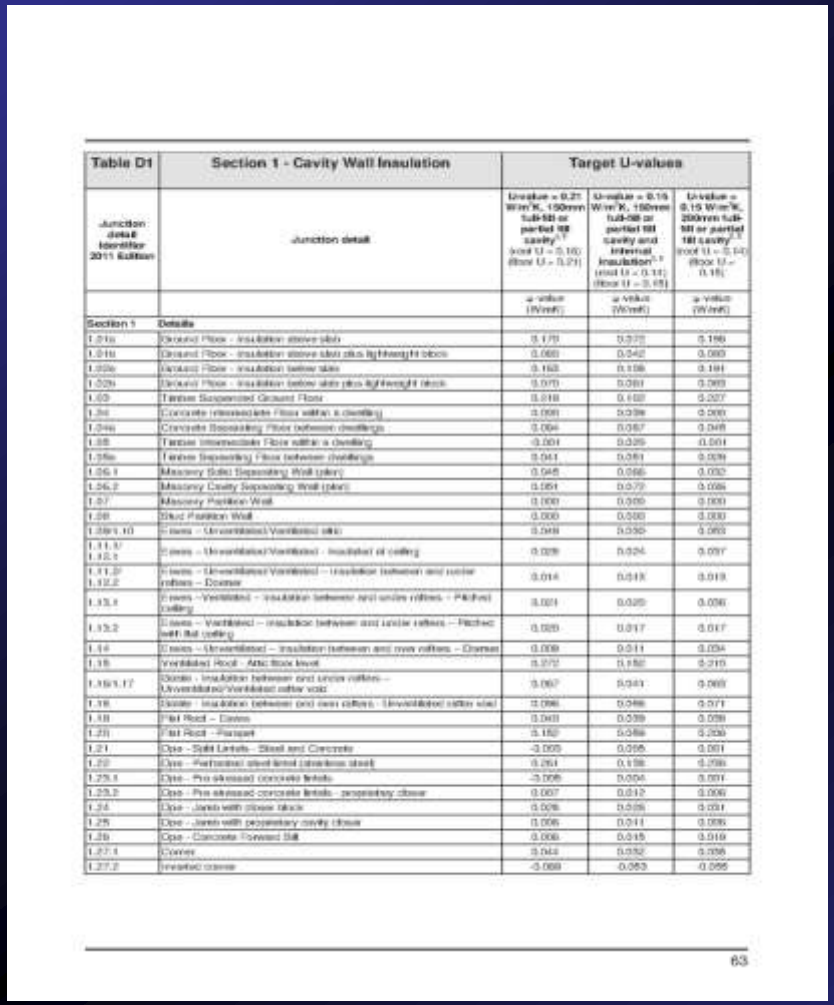


Table D1	Section 1 - Cavity Wall Insulation	Target U-values		
Junction detail identifier 2011 Edition	Junction detail	U-value = 0.21 W/m²K, 150mm full-fill or partial fill cavity[1] (roof U = 0.16) (floor U = 0.21)	U-value = 0.18 W/m²K, 150mm full-fill or partial fill cavity and internal insulation[2,3] (roof U = 0.13) (floor U = 0.18)	U-value = 0.15 W/m²K, 200mm full-fill or partial fill cavity[2,3] (roof U = 0.13) (floor U = 0.15)
		ψ value (W/mK)	ψ value (W/mK)	ψ value (W/mK)
Section 1	Details			
1.01a	Ground Floor - insulation above slab	0.170	0.272	0.196
1.01b	Ground Floor - insulation above slab plus lightweight block	0.060	0.042	0.060
1.02a	Ground Floor - insulation below slab	0.163	0.108	0.181
1.02b	Ground Floor - insulation below slab plus lightweight block	0.070	0.061	0.069
1.03	Timber Suspended Ground Floor	0.018	0.102	0.207
1.04	Concrete intermediate Floor within a dwelling	0.000	0.039	0.000
1.04a	Concrete Separating Floor between dwellings	0.064	0.057	0.048
1.05	Timber intermediate Floor within a dwelling	-0.001	0.025	0.001
1.05a	Timber Separating Floor between dwellings	0.041	0.051	0.039
1.06.1	Masonry (Solid) Separating Wall (plan)	0.045	0.066	0.032
1.06.2	Masonry Cavity Separating Wall (plan)	0.051	0.072	0.036
1.07	Masonry Partition Wall	0.000	0.000	0.000
1.08	Stud Partition Wall	0.000	0.000	0.000
1.09/1.10	Eaves - Unventilated/Ventilated (sill)	0.049	0.050	0.053
1.11.1/ 1.12.1	Eaves - Unventilated/Ventilated - Insulation at ceiling	0.029	0.024	0.027
1.11.2/ 1.12.2	Eaves - Unventilated/Ventilated - Insulation between and under rafters - Dormer	0.014	0.018	0.018
1.13.1	Eaves - Ventilated - Insulation between and under rafters - Pitched ceiling	0.031	0.035	0.036
1.13.2	Eaves - Ventilated - Insulation between and under rafters - Pitched with flat ceiling	0.020	0.017	0.017
1.14	Eaves - Unventilated - Insulation between and over rafters - Dormer	0.009	0.011	0.034
1.15	Ventilated Roof - Attic floor level	0.272	0.152	0.215
1.16/1.17	Gable - Insulation between and under rafters - Unventilated/Ventilated rafter void	0.067	0.041	0.060
1.18	Gable - Insulation between and over rafters - Unventilated rafter void	0.096	0.046	0.071
1.19	Flat Roof - Eaves	0.043	0.039	0.039
1.20	Flat Roof - Parapet	0.152	0.084	0.200
1.21	Ope - Split Lintels - Steel and Concrete	-0.005	0.005	0.001
1.22	Ope - Perforated steel lintel (stainless steel)	0.251	0.138	0.256
1.23.1	Ope - Pre-stressed concrete lintels	-0.006	0.004	0.001
1.23.2	Ope - Pre-stressed concrete lintels - proprietary closer	0.007	0.012	0.006
1.24	Ope - Jamb with closer block	0.009	0.005	0.001
1.25	Ope - Jamb with proprietary cavity closer	0.006	0.011	0.006
1.26	Ope - Concrete Forward Sill	0.006	0.015	0.010
1.27.1	Corner	0.043	0.052	0.056
1.27.2	Inverted corner	-0.069	-0.053	-0.056

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NSAI Thermal Modellers Scheme

- **Table D1 Cavity wall**
- **Table D2 Ext insulation**
- **Table D3 Internal**
- **Table D4 Timber frame**
- **Table D5 Steel frame**
- **Table D6 Hollow block**

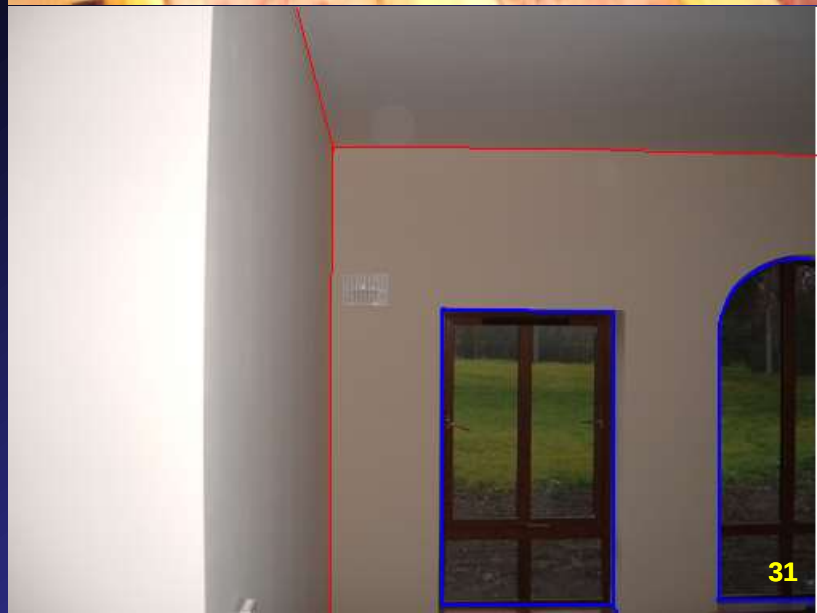
1.3.3.2 (ii) TGD L 2011

Use certified details which have been assessed in accordance, and comply, with Appendix D for all key junctions

Thermal Bridges

- Repeating Thermal bridges
  - Roof Rafters / Ceiling Joists
  - Wall Ties
- These are accounted for in U-Value calculations (Thermally Bridged Calculations)

- Non-repeating / Linear
  - Junctions
  - Lintels
  - Reveals
  - Floor/wall
  - Wall/Ceiling
- These are not accounted for in U-Value calculations

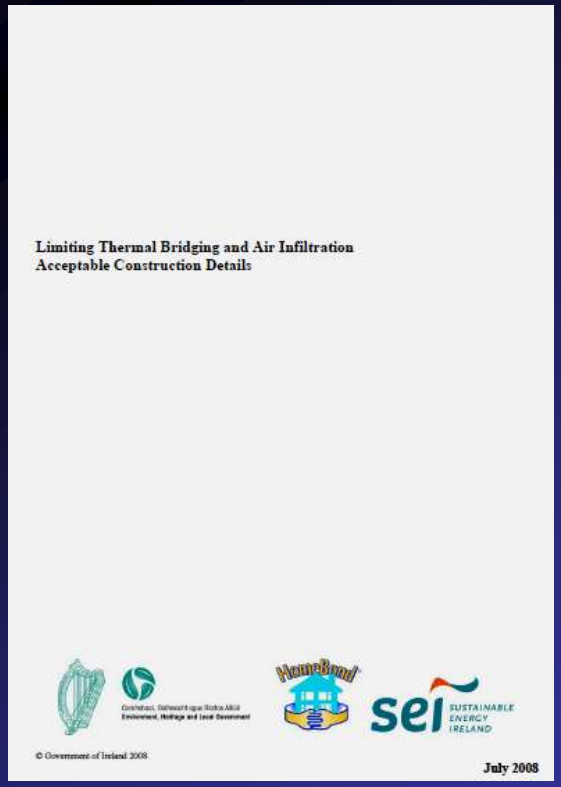


Acceptable Construction Details

- Developed by DEHLG, HomeBond and SEAI.
  - in consultation with an Industry Working Group made up of representatives from different Sectors of the Construction Industry.

- Section 1
  - General theory of insulation continuity & air tightness in construction.

- Section 2 - seven separate parts
  - Indicative detail drawings of thermal insulation
  - Air tightness provisions for specific construction interfaces.



Available on DECLG website www.environ.ie

Acceptable Construction Details Section 2

- Drawings for each construction type.
- 21-25 Drawings for each construction type

  - Type 1 - Cavity wall insulation
  - Type 2 - External insulation
  - Type 3 - Internal insulation
  - Type 4 - Timber Frame
  - Type 5 - Steel Frame
  - Type 6 - Hollow Block Internal Insulation
  - Type G - General Details (common to all constructions)

Thermal Bridging Calculations

DEAP Manual Appendix K & TGD L 2011:

additional heat loss due to thermal bridging is expressed as a multiplier (**y**) applied to the total exposed surface area.

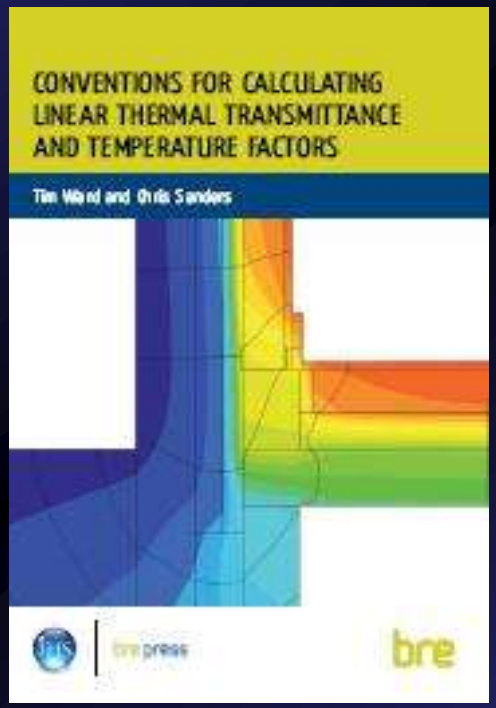
"**y**" can also be derived by calculating each thermal bridge separately in the calculation.

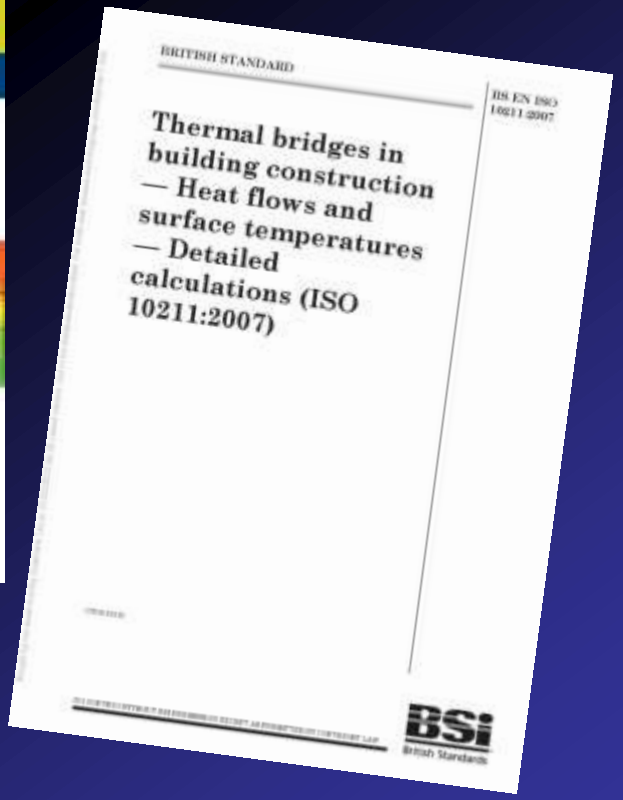
– "**y**" = 0.08 where details comply with the *Acceptable Construction Details*.

– In all other cases "**y**" = 0.15 may be used.

Note: for "**y**" other than 0.08 or 0.15, the details used should be fully specified and their performance certified.

Thermal Bridging





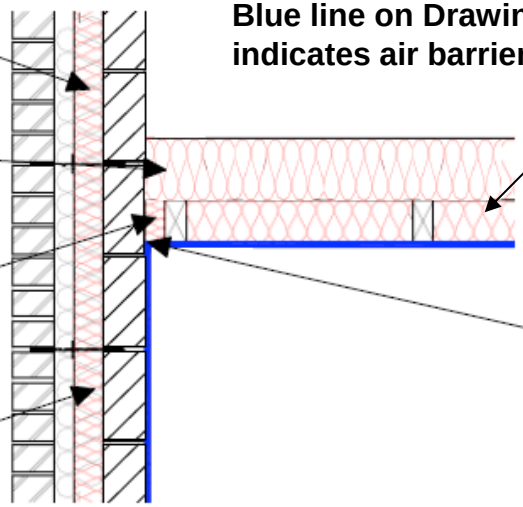
Ventilated Roof - Attic Floor Level

THERMAL PERFORMANCE

CHECKLIST
(TICK ALL)

- ☐ Continue wall insulation a minimum of 250 mm over top of attic insulation
- ☐ Ensure full depth of insulation between and over joists extends to inner edge of wall
- ☐ Pack compressible insulation between last truss or joist, and gable wall
- ☐ Ensure partial fill insulation is secured firmly against inner leaf of cavity wall

Complying with checklist qualifies builder to claim ψ value in Table 3 of IP 1/06 and Table K1 of DEAP 2006



Blue line on Drawing indicates air barrier

AIR BARRIER - CONTINUITY

CHECKLIST
(TICK ALL)

- ☐ Seal all penetrations through air barrier using a flexible sealant
- ☐ Fix ceiling first, and seal all gaps between ceiling and masonry wall with either plaster, adhesive or flexible sealant

Complying with checklist will help achieve design air permeability

GENERAL NOTES

Thermal performance of junction can be improved significantly by using blockwork with a thermal conductivity of ≤.20 W/mK in direction of heat flow in external wall at attic floor level or alternatively by running insulation of R-value 1.5 m^2K/W vertically up internal face of gable wall to a height of 450 mm above ceiling level

Keep cavities clean of mortar snots and other debris during construction

Use of over joist insulation is considered best practice, as it eliminates the cold bridge caused by the joist

Cavity must be closed along the verge

Read this detail in conjunction with details 1-09: Eaves - Ventilated Attic, or 1-10: Eaves - Unventilated Attic, as appropriate

Where different block materials are being used consideration should be given to avoid cracking in plaster at the junction between the block materials

AIR BARRIER - OPTIONS

OPTION
(TICK ONE)

- ☐ Masonry inner leaf with wet-finish plaster, or
- ☐ Masonry inner leaf with scratch coat, and finished with plasterboard, or
- ☐ Inner leaf with plasterboard on dabs, with continuous ribbon of adhesive tape around all openings, along top and bottom of wall, and at internal and external corners, or
- ☐ Airtightness membrane and tapes

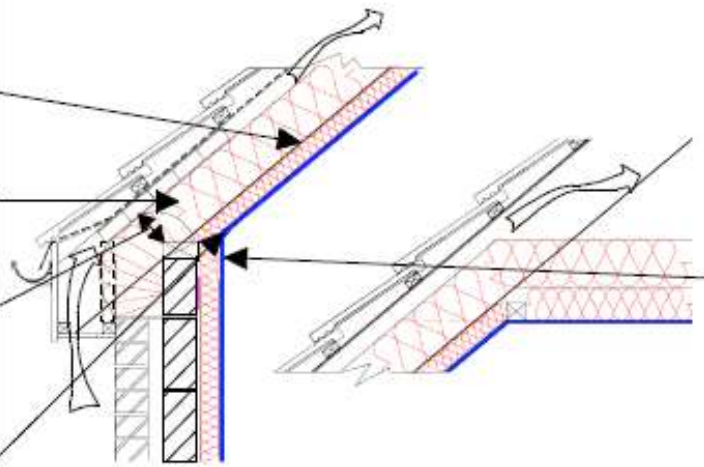
Eaves - Insulation between and under rafters - Ventilated Rafter Void - Pitched ceiling

THERMAL PERFORMANCE

CHECKLIST
(TICK ALL)

- ☐ Ensure continuity of insulation throughout junction
- ☐ Ensure insulation is installed tightly between rafters and is in contact with under-rafter insulation
- ☐ Ensure full depth of insulation between and under rafters abuts eaves insulation
- ☐ Ensure gap between wall plate and proprietary eaves vent is completely filled with insulation having a min. R-value across the insulation thickness of 1.2 m^2 K/W
- ☐ Ensure insulated dry-lining tightly abuts underside of ceiling

Complying with checklist qualifies builder to claim ψ value in Table 3 of IP 1/06 and Table K1 of DEAP 2006



AIR BARRIER - CONTINUITY

CHECKLIST
(TICK ALL)

- ☐ Bed wall plate on continuous mortar bed
- ☐ Fix ceiling first, and seal all gaps between ceiling and masonry wall with either adhesive or flexible sealant
- ☐ Seal all penetrations through air barrier using a flexible sealant

Complying with checklist will help achieve design air permeability

GENERAL NOTES

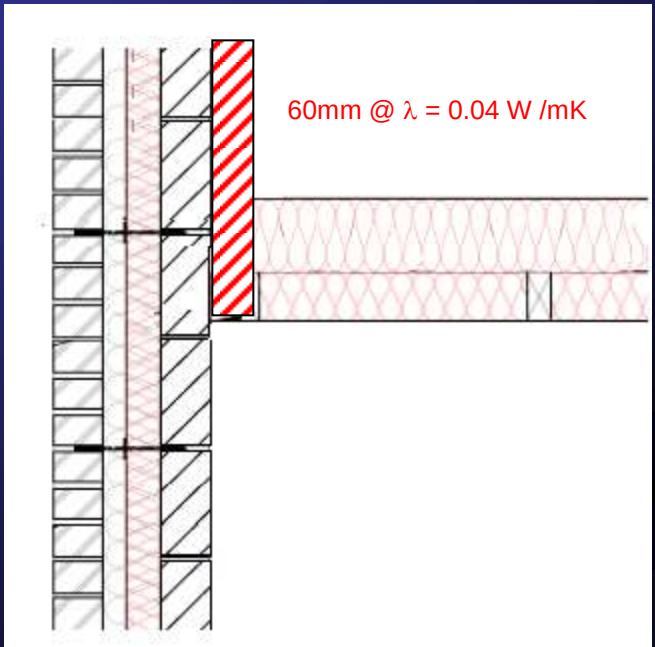
Thermal performance of junction can be improved by incorporating an eaves wind barrier (plywood, OSB, softboard or other suitable material) around insulation to be sealed to connect with the ventilator strip thereby mitigating wind chill from the vent inlet in the eaves.
Use a proprietary eaves ventilator to ensure ventilation in accordance with BS5250. Installation of the eaves ventilator must not prevent free water drainage below the tiling battens
If required by BS5250, use vapour control plasterboard or separate vapour control layer behind plasterboard.
Use of over joist and under rafter insulation is considered best practice, as it eliminates the cold bridge caused by the joist/rafter
Read this detail in conjunction with detail 3-16, Gable - Ventilated Rafter Void

AIR BARRIER - OPTIONS

OPTION
(TICK ONE)

- ☐ Masonry inner leaf, with scratch coat applied to internal face of inner leaf, with insulated dry-lining on dabs or mechanically fixed pre-treated timber battens, or
- ☐ Insulated dry-lining on dabs or battens, with continuous ribbon of adhesive tape around all openings, along top and bottom of wall, and at internal and external corners, or
- ☐ Airtightness membrane and tapes

Recommendation to further reduce Thermal Bridging



GENERAL NOTES

Thermal performance of junction can be improved significantly by using blockwork with a thermal conductivity of ≤.20 W/mK in direction of heat flow in external wall at attic floor level or alternatively by running insulation of R-value 1.5 m^2K/W vertically up internal face of gable wall to a height of 450 mm above ceiling level

Keep cavities clean of mortar snots and other debris during construction

Use of over joist insulation is considered best practice, as it eliminates the cold bridge caused by the joist

Cavity must be closed along the verge

Appendix E – EPC, CPC

Table E1 Example Dwellings	
Element or system	**Specifications**
Dwelling size and shape	Semi-detached house, two-storey Overall internal dimensions: 7 m wide x 9 m deep x 5.1 m high Total floor area 126 m^2 Rectangular shape with no irregularities
Opening areas (windows and doors)	25% of total floor area The above includes one opaque door of area 1.85 m^2, any other doors are fully glazed
Walls	U = 0.13 W/m^2K e.g. 150 mm cavity wall with 100 mm cavity insulation of thermal conductivity 0.022 W/mK and 60 mm internal insulation of conductivity 0.022 W/mK
Roof	U = 0.11 W/m^2K e.g. 360 mm insulation of conductivity 0.04 W/mK, between and over ceiling joists
Floor	U = 0.14 W/m^2K e.g. Slab-on-ground floor with 120 mm insulation of conductivity 0.023 W/mK
Opaque door	U = 1.5W/m^2K
Windows and glazed doors	Double glazed, low E (En = 0.05, soft coat) 20 mm gap, argon filled, PVC frames (U = 1.3 W/m^2K, solar transmittance = 0.63)
Living area fraction	25% of total floor area
Shading and orientation	All glazing oriented E/W; average overshading
Number of sheltered sides	2
Allowance for thermal bridging at element junctions	0.05 x total exposed surface area (W/m^2K)
Internal heat capacity category	Medium
Ventilation system	Natural ventilation with intermittent extract fans
Air permeability	Infiltration due to structure = 0.25 ac/h ($5m^3$/(hr.m^2)@50pa)
Chimneys	None
Open flues	None
Extract fans	3
Draught lobby	One
Primary heating fuel (space and water)	Mains gas
Heating system	Boiler and radiators with energy efficient water pump in heated space
Boiler	Mains gas condensing boiler, seasonal efficiency 91.3%, room-sealed, fanned flue
Heating System Controls	Time and Temperature Zone Control
Hot water system	Solar water heating system with evacuated tube collector of aperture area = 5.0 m^2, η^1 = 0.6, a^1 = 3.0 W/m^2K, facing SE/SW at 30 degrees and unshaded, twin coil cylinder 330 litre with 100 mm insulation Remainder of demand met by space heating boiler, separate time control for space and water heating, cylinder temperature controlled by thermostat
Primary water heating losses	Insulated primary pipework between boiler and cylinder
Secondary space heating	Gas fire, closed front, fan assisted, balanced flue – efficiency 80%
Low energy light fittings	100%

Wall – 0.13 W/m²K
Roof – 0.11 W/m²K
Floor – 0.14 W/m²K
Windows – 1.3 W/m²K

Y value – 0.05 W/m²K
Air Tightness – 0.25 ac/h

Building Envelope Air Permeability

Air Tightness Pressure Tests

q50 = $m^3/(hr.m^2)$ @ 50Pa (per Dwelling Type)

Upper limit air permeability of 7 $m^3/(hr.m^2)$

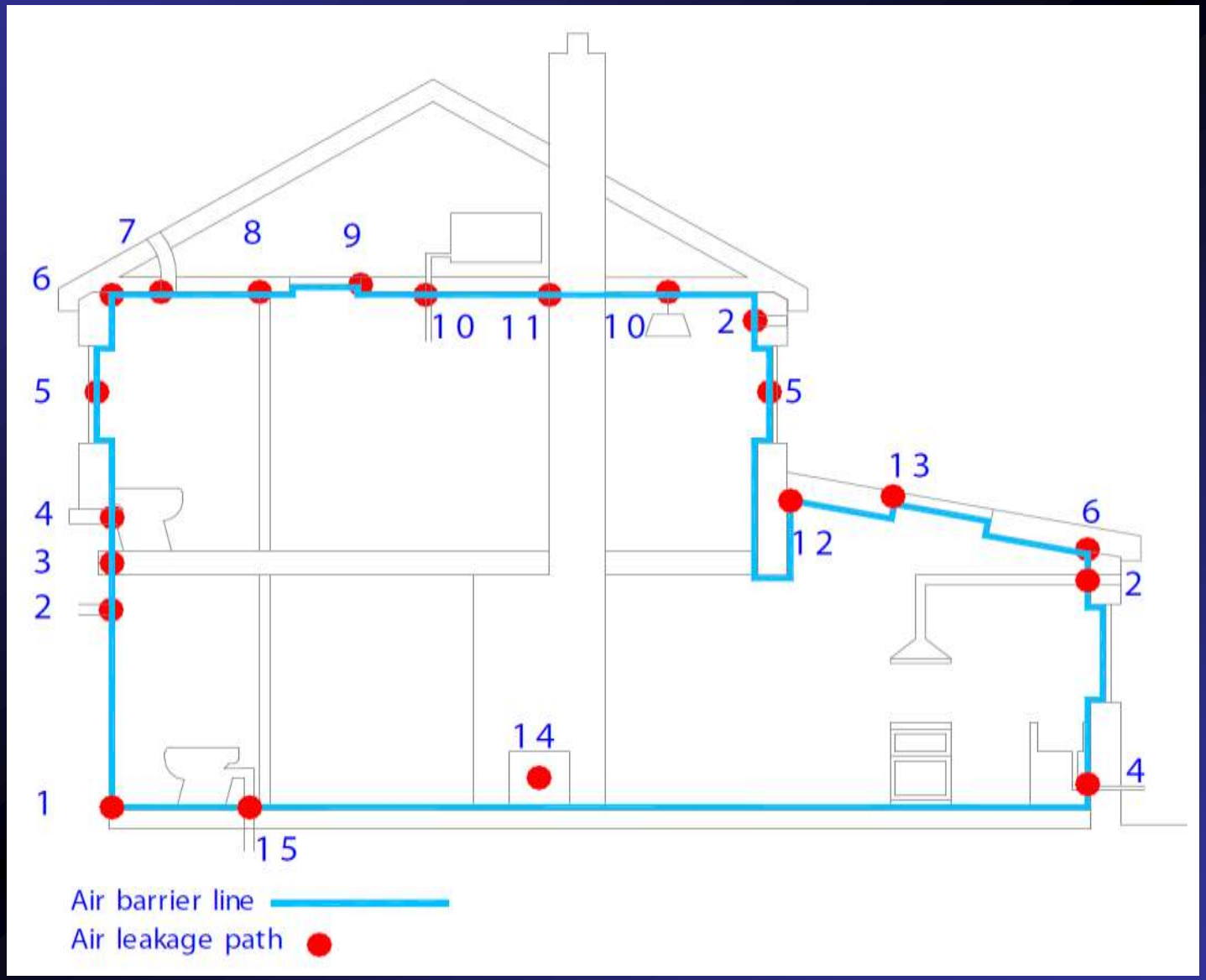
Best practice: q50< 3$m^3/(hr.m^2)$

Passive House: 0.6 ach

Number of units	Number of tests
4 or less	1 test
Greater than 4 but equal or less than 40	2 tests
Greater than 40 but equal or less than 100	At least 5% of the dwelling type
More than 100	
(a) where the first five tests achieved the design air permeability	At least 2% (for dwellings in excess of the first 100 units)
(b) where one or more of the first five test do not achieve the design air permeability	At least 5% of units, until 5 successful consecutive tests are achieved, 2% thereafter

Common Air Leakage Paths

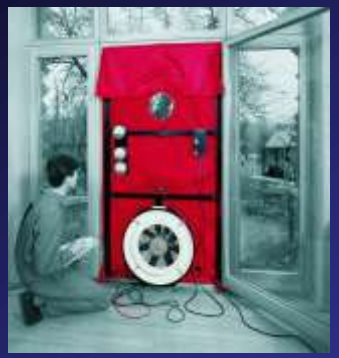
HomeBond House Building Manual @ Page 509



Airtightness…How?

1. Design for airtightness

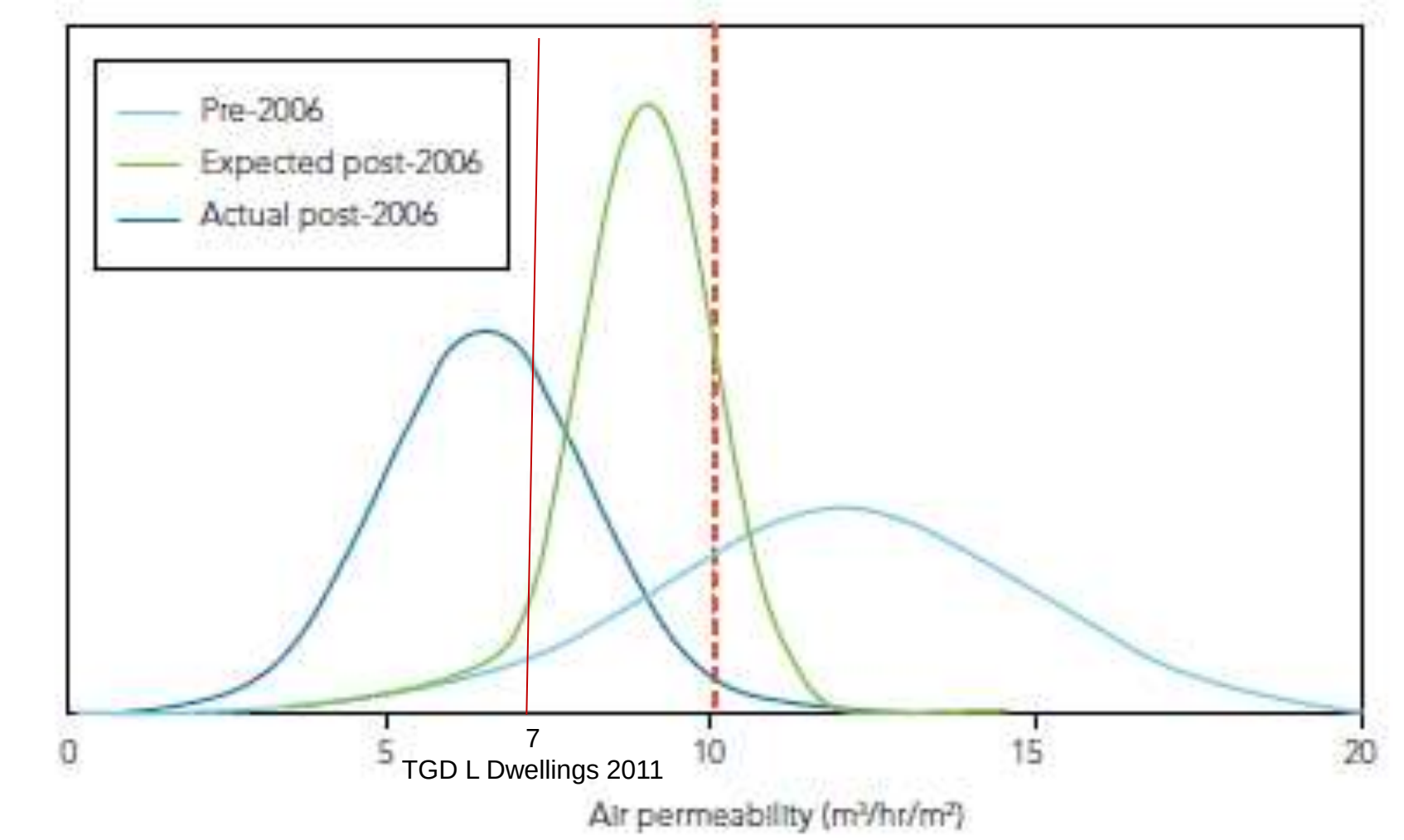
Communication & Coordination



2.Build to achieve airtightness

3.Test for airtightness

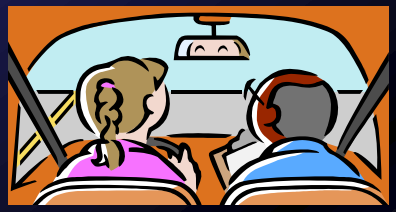
NHBC Foundation - UK Data



TGD L Dwellings 2011

Control & Responsiveness

Control



e.g. Programmer & Thermostat V's On/off Switch

Responsiveness

e.g. Radiators V's Storage Heating

The greater the controls & responsiveness of the systems, the greater benefits allowed in the DEAP calculation software.

SR 50 Code of Practice for Building Services - Part 1 - Domestic Heating and Plumbing

(Post Public Enquiry Stage)

Contents

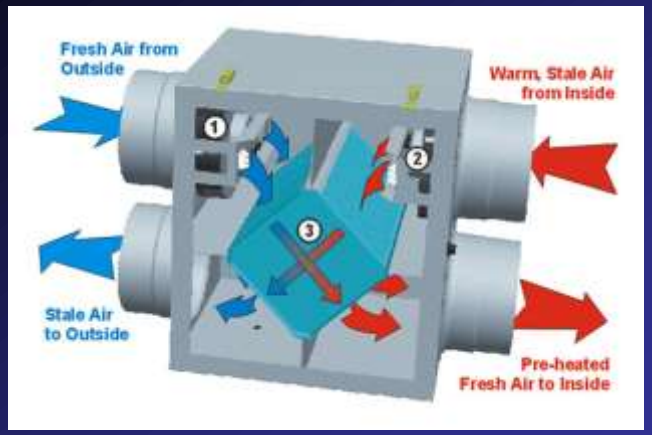
- Cold Water supply systems
- Hot water supply systems
- Above ground sanitation systems
- Space heating systems – System design
- System selection
- Central Heating distribution system
- System control
- Interlocking
- Commissioning, Handover & Maintenance

Mechanical Ventilation Systems

TGD L 2011 @ 1.4.5.2 Page 22

- Heat recovery ventilation recommended < 5 $m^3/(hr.m^{2)}$
  - Design & Installation GPG 268, SAP Appendix Q
  - Certified systems
  - Continuous Operation
  - Airtight House
  - Maintenance
    - Cleaning Filters
    - Changing Filters
    - Servicing

Table 3	Minimum performance levels for mechanical ventilation systems
System type	**Performance**
Specific Fan Power (SFP) for continuous supply only and continuous extract only	0.8 W/litre/sec
SFP for balanced systems	1.5 W/litre/sec
Heat recovery efficiency	66%



MVHR - How it works

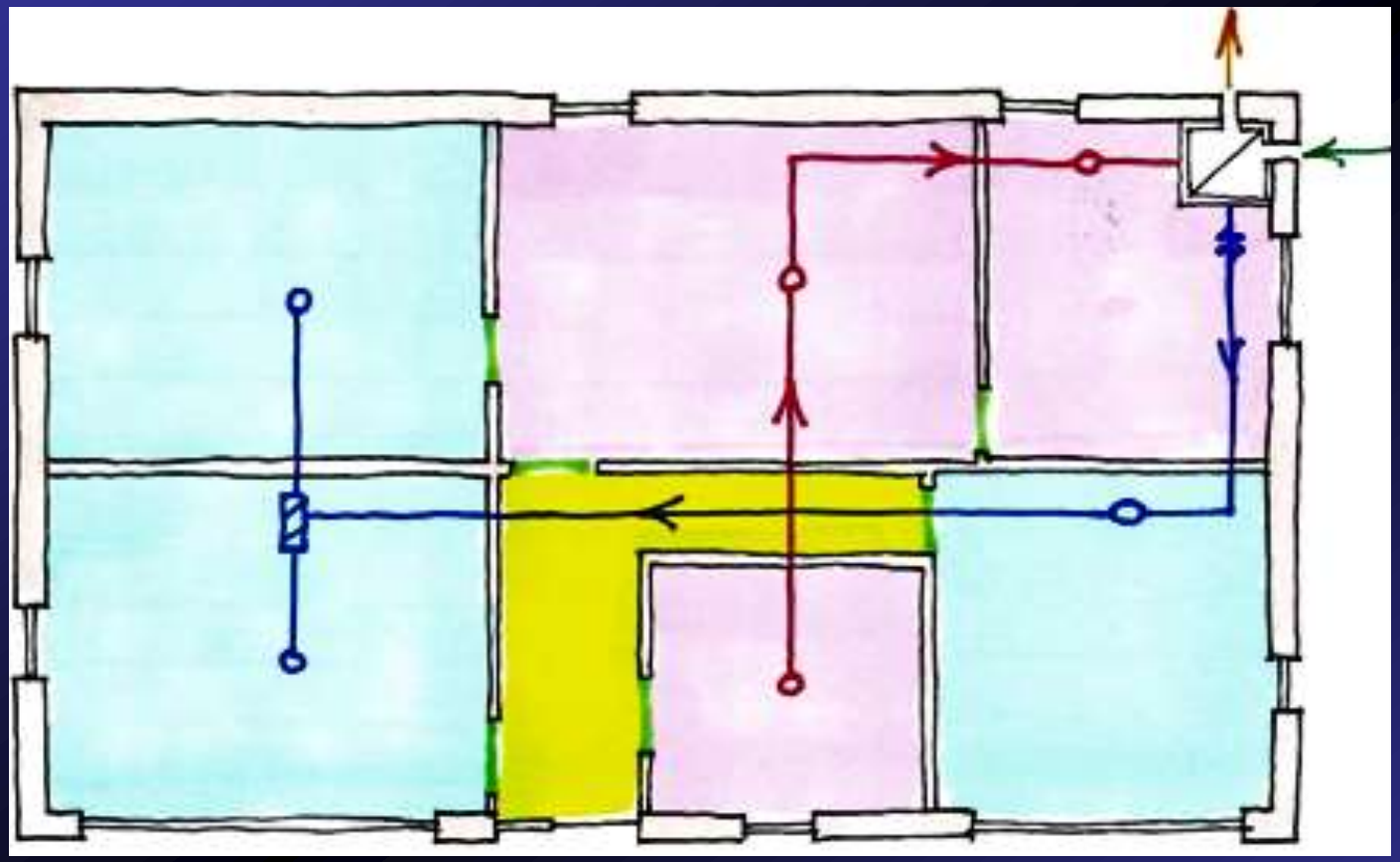
- Used in airtight houses to provide a continuous controlled supply of fresh air. Moist warm air is extracted from the kitchen, bathroom and utility rooms. The heat in this air is transferred to the cool fresh air drawn in from outside. This warm fresh air is supplied to the living room and bedroom

- The extracted air and supply air do not mix. Instead they pass either side of a heat exchange plates that allow the transfer of heat energy. The fresh air is filtered as it enters the house for pollen and dust. This provides better air quality that simply opening a window. The MHRV should be located to allow easy changing of filters.

- During cold weather a post heating element is used to raise the temperature of the incoming air to ensure a constant comfortable temperature of 20 degrees is maintained in the home at all times. During warm weather a summer bypass is used to prevent over heating.

- A sound attenuator is used to ensure that noise does not transfer from one space to another. This is particularly important for bedrooms.

MVHR - How it works



The design of the system must be balanced for the entire dwelling to ensure that a minimum air change rate of 0.3 changes per hour is achieved.

Passivhaus

Box 3: A summary of Passivhaus requirements

Space heating demand	≤ **15** kWh/m²yr
Space cooling demand	≤ **15** kWh/m²yr
Airtightness	≤ **0.6** ach @ 50 Pa

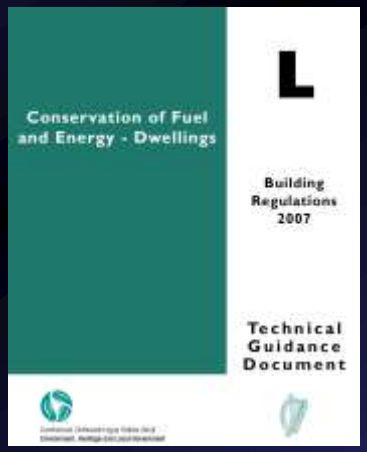
Passivhaus software

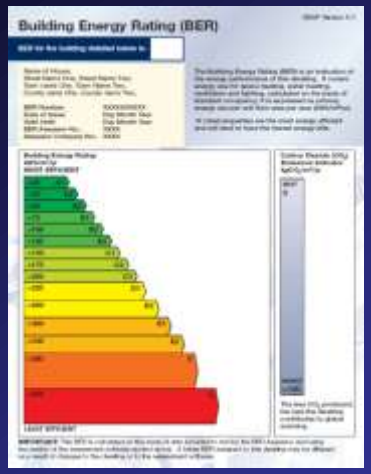
Air Permeability = Air Leakage / Envelope Area

Air Changes per hour = Air Leakage / Volume

Additional Passivhaus guidelines
Insulation
U-values of walls, floors and roofs ≤ 0.15 W/m²K
Glazing
Triple-pane windows with insulated frames U-values (including doors) ≤ 0.8 W/m²K
Solar orientation
Windows largely south-facing
Thermal bridging
Minimal (ideally non-existent) psi-(Ψ) values ≤ 0.01 W/mK
Ventilation
High-efficiency MVHR system Heat recovery efficiency ≥ 75%, specific fan power ≤ 1.62 W/(l/s)
Appliances
Low-energy lights and appliances throughout
Overheating
Special care to avoid summertime overheating

DEAP Software





BER Assessor

- NEAP is used for Buildings other than Dwellings

DEAP Output

Property Details

Dwelling Type	Detached house	Type Of BER Rating	New Dwelling - Provisional
Address line 1	Home Type 1	Year of Construction	2014
Address line 2	Option C	Date of Assessment	24/01/2014
Address line 3	Air / Water Heat Pump	Date of Plans	24/01/2014
County	Co. Dublin	Planning Reference	
Post Code		Building Regulations	2011 TGD L
Has a rating been previously submitted?	No	Is MPRN shared with another dwelling?	No
BER Number		MPRN No.	
Purpose of rating	Sale		
Comment			
Client Name	HomeBond Technical Services Ltd	Client Phone	
Address line 1	Construction House	Client Email	
Address line 2	Canal Road	Assessor Name	Conor Kavanagh
Address line 3		Assessor Reg No.	100565
County	Dublin 6	Developer Name	
Post Code		Development Name	

DIMENSION DETAILS

	Area [m²]	Height [m]	Volume [m³]
Ground Floor	78.00	2.70	210.60
First Floor	78.00	2.70	210.60
Second Floor			0.00
Third and other floors			0.00
Room in roof			0.00
Total Floor Area	156.00		421.20
Living Area [m²]	28.00	Living area percentage [%]	17.95
No of Storeys	2		

VENTILATION DETAILS

	Number		
Chimneys	0	Has a permeability test been carried out?	Yes
Open Flues	0	Result of air permeability test in ach	0.350
Fans & Vents	3	Is there a suspended wooden ground floor?	
Number of flueless combustion room heaters	0	Percentage windows/doors draughtstripped [%]	
Is there a draught lobby on main entrance?	No	Number of sides sheltered	2
Ventilation method			Natural ventilation
Specific fan power [W/(l/s)]			Not Applicable
Heat exchanger efficiency [%]			Not Applicable
Mechanical Ventilation Manufacturer			Not Applicable
Mechanical Ventilation Model Name			Not Applicable
How many wetrooms (incl. kitchen)? Is the vent. ducting flexible/rigid/both?			4

BUILDING ELEMENTS - Floor Details

Type	Description	U-Value [W/m²K]	Area [m²]	Underfloor heating
Ground Floor - Solid	Solid Floating Concrete Slab on Insulation	0.150	78.000	No

BUILDING ELEMENTS - Roof Details

Type	Description	U-Value [W/m²K]	Area [m²]
Pitched Roof – Insulated on Ceiling	300mm fibreglass	0.130	78.000

BUILDING ELEMENTS - Wall Details

Type	Description	U-Value [W/m²K]	Area [m²]
Other	Base Specification	0.200	174.300

BUILDING ELEMENTS - Door Details

Description	Number of Doors	U-Value [W/m²K]	Area [m²]
Front Door	1	1.400	2.100

BUILDING ELEMENTS - Window Details

Glazing type	User defined u-value	U-Value [W/m²K]	Area [m²]
Triple-glazed, argon filled (low-E, ε_n = 0.05, soft coat)	Yes	1.100	10.800
Triple-glazed, argon filled (low-E, ε_n = 0.05, soft coat)	Yes	1.100	13.200
Triple-glazed, argon filled (low-E, ε_n = 0.05, soft coat)	Yes	1.100	4.800

OTHER DETAILS

Thermal bridging factor [W/m²K]	0.0000	Thermal mass category of dwelling	Medium-high
Low Energy Lighting [%]			100

HEATING SYSTEM - Solar Water Heating

Solar Water Heating Present?	No	Aperture area of solar collector [m²]	n/a
Type, manufacturer, model	n/a		
Zero loss collector efficiency, η_0	n/a	Collector heat loss coefficient, a1 [W/m²K]	n/a

DEAP Output

Annual Solar Radiation [kWh/m²] (Refer to Appendix H in DEAP)	n/a	Overshading factor	n/a
Dedicated storage volume [Litres]	n/a	Combined Cylinder	n/a
Solar fraction [%]	88.36		
HEATING SYSTEM - Hot Water System			
Distribution Losses	Yes	Combi boiler present?	No
Supplementary electric water heating	No	Water Storage Volume [L]	250
Hot water storage manufacturer and model name	NSAI Agrement (Sample)	Declared loss factor [kWh/d]	2.150
Temperature factor unadjusted (table 2 in DEAP)	0.60	Temperature factor multiplier (table 2 in DEAP)	0.90
Primary Circuit loss type	Boiler with insulated primary pipework and with cylinder thermostat		
Is hot water storage indoors or in group heating system	Yes		

HEATING SYSTEM – Dist. system losses and gains (Table 4 in DEAP)					
Temperature adjustment [°C]	0.000	Control Category	3	Responsiveness category	2
Central heating pumps	1	Oil Boiler Pump	0	Oil boiler pump inside dwelling	No
Gas boiler flue fan	0	Warm air heating or fan coil radiators present			No
HEATING SYSTEM – Energy Requirements (Individual)					
Main space heating system efficiency [%]	390.00	Space heating efficiency adjustment factor	1.0000	Main space heating fuel	Electricity
Main water heating system efficiency [%]	390.00	Water heating efficiency adjustment factor	0.7000	Main water heating fuel	Electricity
Secondary heating system efficiency [%]		Fraction of heating from secondary heating system		Secondary space heating system fuel	None
Fraction of main space and water heat from CHP		Electrical efficiency of CHP		Heat efficiency of CHP	
CHP Fuel type	None				

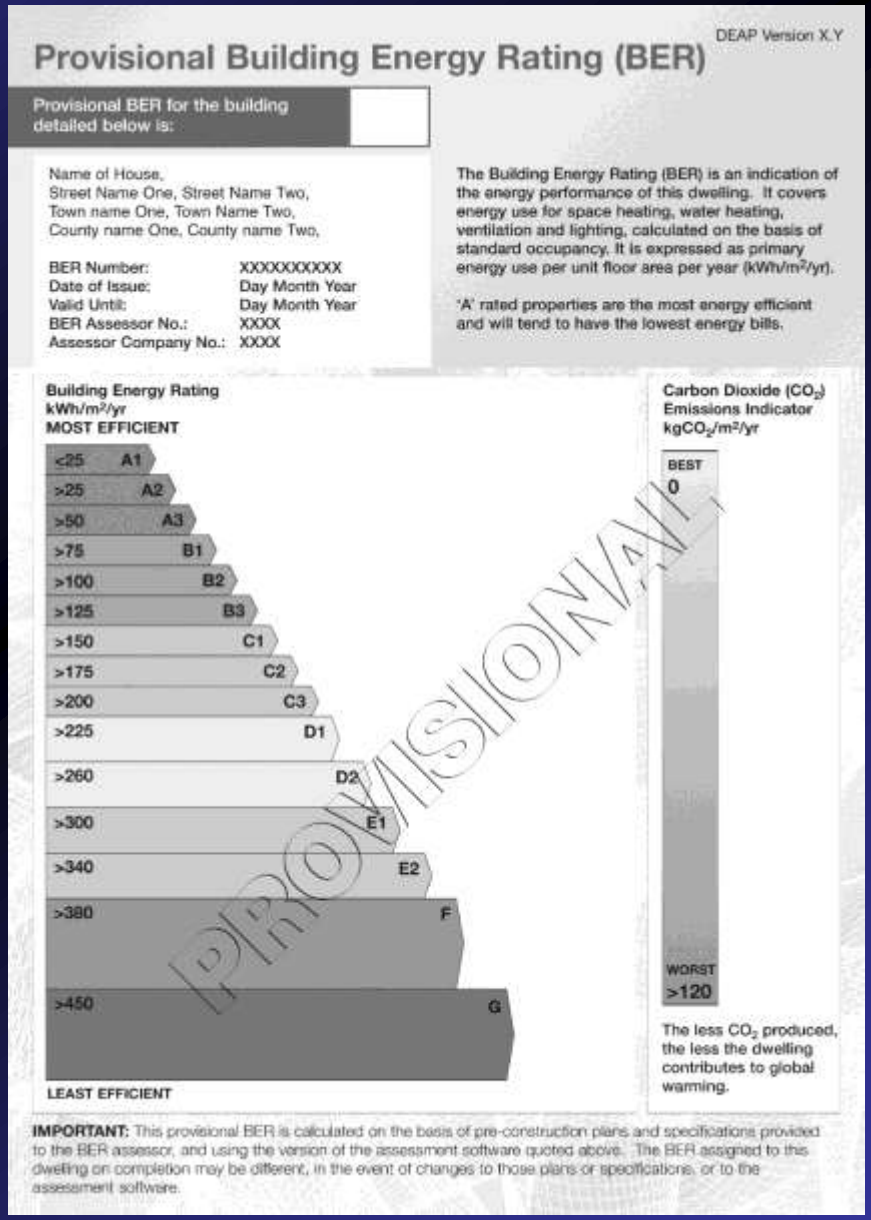
SUMMARY FOR PART L CONFORMANCE (Applies to TGD L 2008/2011 for new dwellings only)			
BER Number		Building Regulations	2011 TGD L
BER Result	A3	Energy Value kWh/m²/yr	88.18
CO2 emissions [kg/m²/yr]	12.49	Total compliance with Part L in DEAP?	Pass
EPC	0.358	EPC Pass/Fail	Pass
CPC	0.383	CPC Pass/Fail	Pass

PART L CONFORMANCE - Fabric					
Conformity with Maximum avg U-value requirements	U-value[W/m²K]	Pass / Fail	Conformity with Maximum U-value requirements	U-Value [W/m²K]	Pass / Fail
Pitched roof insulated on ceiling	0.13	Pass	Roofs	0.13	Pass
Pitched roof insulated on slope	0.00	Pass	Walls	0.20	Pass
Flat Roof	0.00	Pass	Floors	0.15	Pass
Floors with no underfloor heat	0.15	Pass	External doors / windows / rooflights	1.40	Pass
Floors with underfloor heat	0.00	Pass			
Walls	0.20	Pass			
Percentage of opening areas [%]	19.8	Pass			
Average U value of openings	1.12				
Permeability test carried out and meets guidelines in TGD L					

PART L CONFORMANCE – Renewables (Individual heating system)		
Type of renewable	Total contribution [kWh/y]	Part L renewable contribution [kWh/m²/y]
Solar water heating system	0.00	0.00
Heat pump as main space heating system	1898.82	12.17
Heat pump as secondary space heating system	0.00	0.00
Heat pump as main water heating system	368.77	2.36
Wood/Biomass heater as main space heating system	0.00	0.00
Wood/Biomass heater as secondary heating system	0.00	0.00
Wood/Biomass heater as main water heating system	0.00	0.00
Contribution from CHP	0.00	0.00
	0.00	0.00
	0.00	0.00
	0.00	0.00
Total thermal	2267.59	14.54
Total electrical	0.00	0.00
Total thermal equivalent	2267.59	14.54
Does total thermal equivalent meet part L requirement?	Pass	

Provisional BER Certificate

- valid 2 years



DEAP Version X.Y

Provisional Building Energy Rating (BER)

Provisional BER for the building detailed below is:

Name of House,
Street Name One, Street Name Two,
Town name One, Town Name Two,
County name One, County name Two,

BER Number:	XXXXXXXXXX
Date of Issue:	Day Month Year
Valid Until:	Day Month Year
BER Assessor No.:	XXXX
Assessor Company No.:	XXXX

The Building Energy Rating (BER) is an indication of the energy performance of this dwelling. It covers energy use for space heating, water heating, ventilation and lighting, calculated on the basis of standard occupancy. It is expressed as primary energy use per unit floor area per year (kWh/m²/yr).

'A' rated properties are the most energy efficient and will tend to have the lowest energy bills.

Building Energy Rating
kWh/m²/yr
MOST EFFICIENT

<25	A1
>25	A2
>50	A3
>75	B1
>100	B2
>125	B3
>150	C1
>175	C2
>200	C3
>225	D1
>260	D2
>300	E1
>340	E2
>380	F
>450	G

LEAST EFFICIENT

Carbon Dioxide (CO_2) Emissions Indicator
$kgCO_2/m^2/yr$

BEST
0
WORST
>120

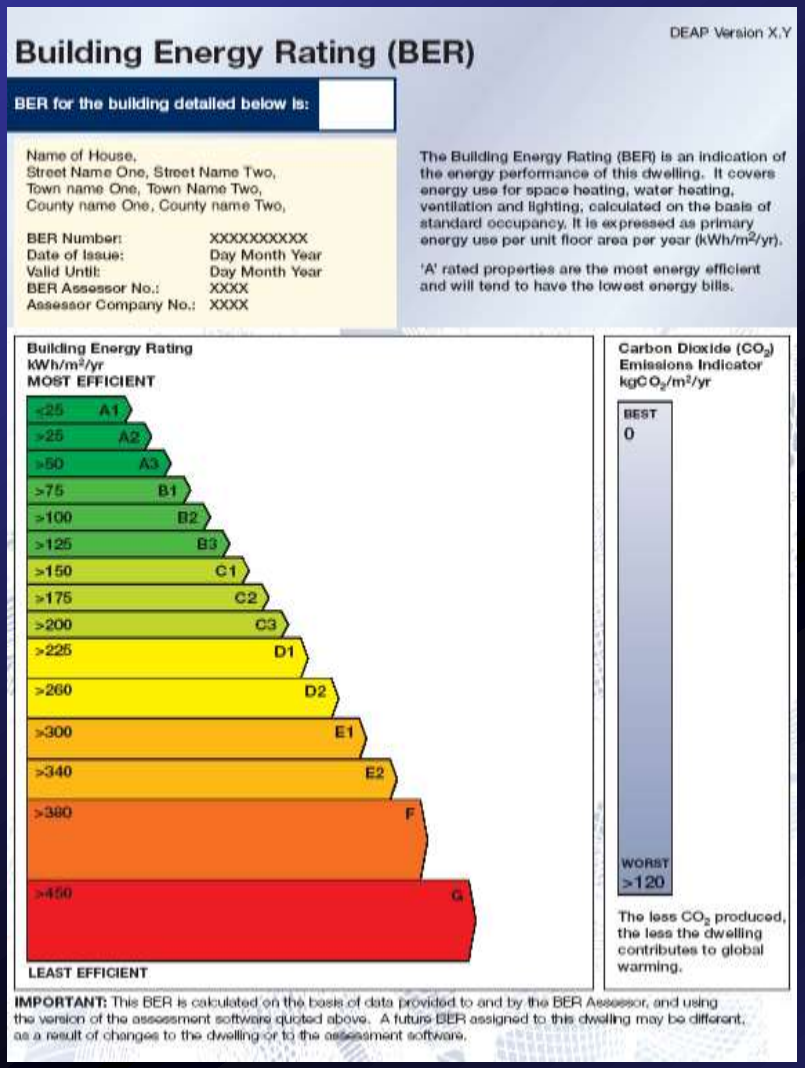
The less CO_2 produced, the less the dwelling contributes to global warming.

PROVISIONAL

IMPORTANT: This provisional BER is calculated on the basis of pre-construction plans and specifications provided to the BER assessor, and using the version of the assessment software quoted above. The BER assigned to this dwelling on completion may be different, in the event of changes to those plans or specifications, or to the assessment software.

BER Certificate

Kwh/m^2/yr



Building Energy Rating (BER)

DEAP Version X.Y

BER for the building detailed below is:

Name of House,
Street Name One, Street Name Two,
Town name One, Town Name Two,
County name One, County name Two,

BER Number:	XXXXXXXXX
Date of Issue:	Day Month Year
Valid Until:	Day Month Year
BER Assessor No.:	XXXX
Assessor Company No.:	XXXX

The Building Energy Rating (BER) is an indication of the energy performance of this dwelling. It covers energy use for space heating, water heating, ventilation and lighting, calculated on the basis of standard occupancy. It is expressed as primary energy use per unit floor area per year (kWh/m^2/yr).

'A' rated properties are the most energy efficient and will tend to have the lowest energy bills.

Building Energy Rating
kWh/m^2/yr
MOST EFFICIENT

≤25	A1
>25	A2
>50	A3
>75	B1
>100	B2
>125	B3
>150	C1
>175	C2
>200	C3
>225	D1
>260	D2
>300	E1
>340	E2
>380	F
>450	G

LEAST EFFICIENT

Carbon Dioxide (CO_2) Emissions Indicator
kgCO_2/m^2/yr

BEST
0

WORST
>120

The less CO_2 produced, the less the dwelling contributes to global warming.

IMPORTANT: This BER is calculated on the basis of data provided to and by the BER Assessor, and using the version of the assessment software quoted above. A future BER assigned to this dwelling may be different, as a result of changes to the dwelling or to the assessment software.

- Calculated using DEAP software.
- No minimum standard applies.
- BER is valid for 10 years unless changes are made to the building.
- The BER is independant of how the occupants manage the building heating.
- Advisory Report
- BER Assessor

Indicative CO_2 emissions and running costs for different rating bands:

Rating	2 Bed Apartment (75m²)		3 Bed Semi-D (100m²)		4 Bed Detatched (200m²)	
	Tonnes CO_2	Cost	Tonnes CO_2	Cost	Tonnes CO_2	Cost
A2	0.8	€ 230	1.1	€ 300	2.2	€ 600
B1	1.2	€ 340	1.6	€ 460	3.3	€ 900
C1	2.3	€ 600	3.1	€ 900	6.2	€ 1,700
D1	3.7	€ 1,000	4.9	€ 1,400	9.8	€ 2,700
E1*	5	€ 1,400	6.7	€ 1,800	13.3	€ 3,700
F*	6.8	€ 1,900	9	€ 2,500	18.1	€ 5,000
G*	8.5	€ 2,400	11.3	€ 3,100	22.6	€ 6,300

** Running costs are estimated on the basis of typical occupancy and heating the entire dwelling to a comfortable level throughout the year*

kWh — *Annual kilowatt hours of primary energy. (Natural gas and electricity are purchased in terms of "units" or kWh. 1 litre of kerosene has an energy content of just over 10 kWh)*

CO_2 — *Tonnes of CO_2 emitted per annum*

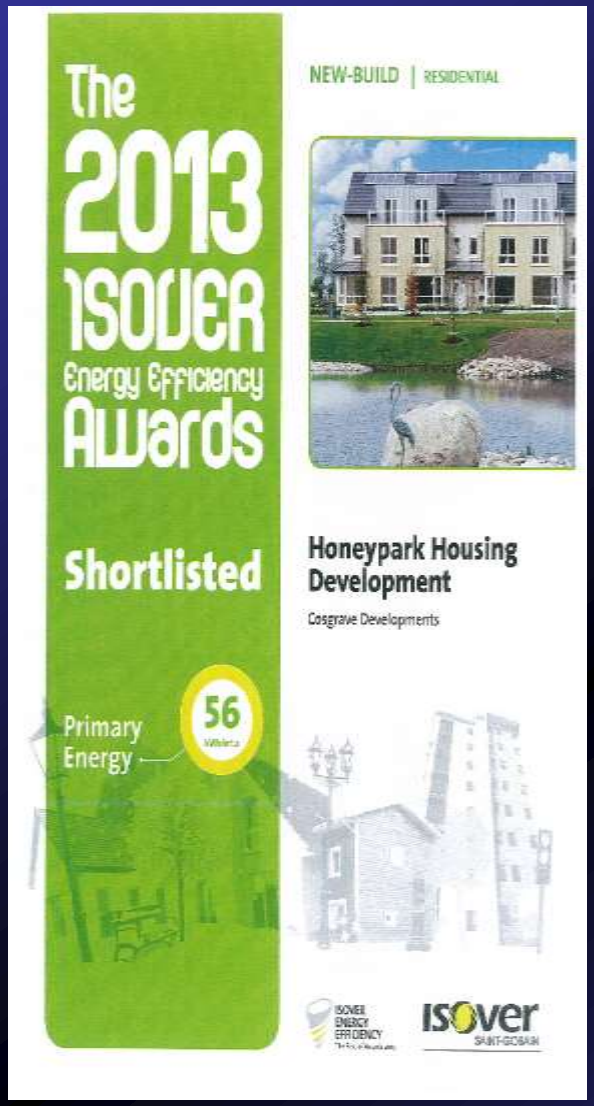
Cost — *Annual running cost for principal energy usage, based on an average of domestic oil and gas prices as of July 2010.*

Regulation L1 & EPBD New Dwellings

TGD L	BER (Avg Dwelling)	Kwh/m^2/yr (Avg Dwelling)	EPC	CPC
2002/05	C1/B3	150	1.0 (Baseline)	
2008	B1	90	0.6	0.69
2011	A3	60	0.4	0.46
2013/20	A2	45	0.3	0.345

2013/20 Based on note under Table 4 of the RIA 2010 (70% reduction)

SUSTAINABLE ENERGY AWARDS



ICSH AWARDS:

Mixed Communities

Winner: Tuath Housing Association - Honeypark, Dun Laoghaire, Co. Dublin
The Judging Panel highlighted the project as being "a most effective example of achieving the right balance of mixed community occupancy in harmony with the surrounding developments" and highlighted the "excellent holistic design for environmental sustainability including a strategy for post occupancy energy and waste management".

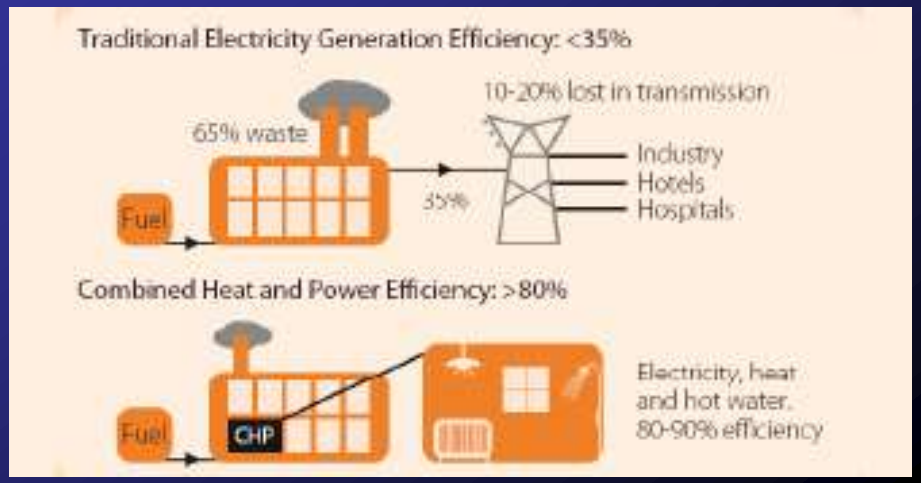
COSGRAVE PROPERTY GROUP

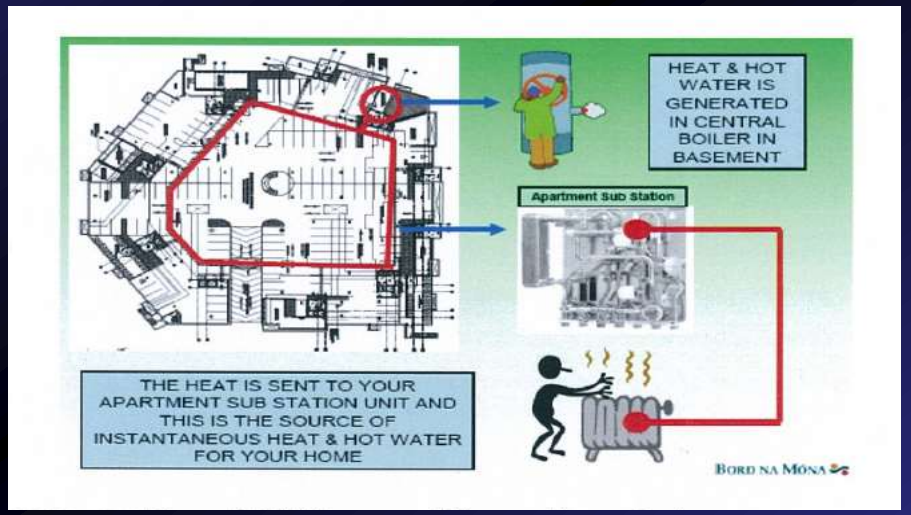
ROCHDALE, HONEYPARK

HONEYPARK DESIGN TEAM:	
DEVELOPER:	COSGRAVE DEVELOPMENTS
ARCHITECT:	McCROSSAN O'ROURKE MANNING
STRUCTURAL ENGINEER:	MOYLANS
M&E CONSULATANT:	COAKLEY McELLIGOTT
LANDSCAPE ARCHITECT:	MITCHELL & ASSOCIATED
H&S CONSULTANT:	OLM CONSULTANCY

COSGRAVE PROPERTY GROUP

Combined Heat Power (CHP)





Combined Heat Power (CHP)

Frontline
Energy & Environmental

ROCHDALE - HONEY PARK

HEATING SYSTEM – MANUAL FOR RESIDENTS

COMPILED BY

FRONTLINE ENERGY & ENVIRONMENTAL
January 2014

District Heating Installation options: GSM or M-Bus

Prepago Control & Admin

Prepago App

Prepago.ie

GSM

GSM

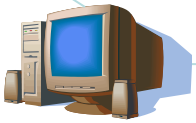
SKID

SCU

SCU

SKID

Data Logger



M-Bus Feed of meter data

SCU Prepago Smart Control Unit

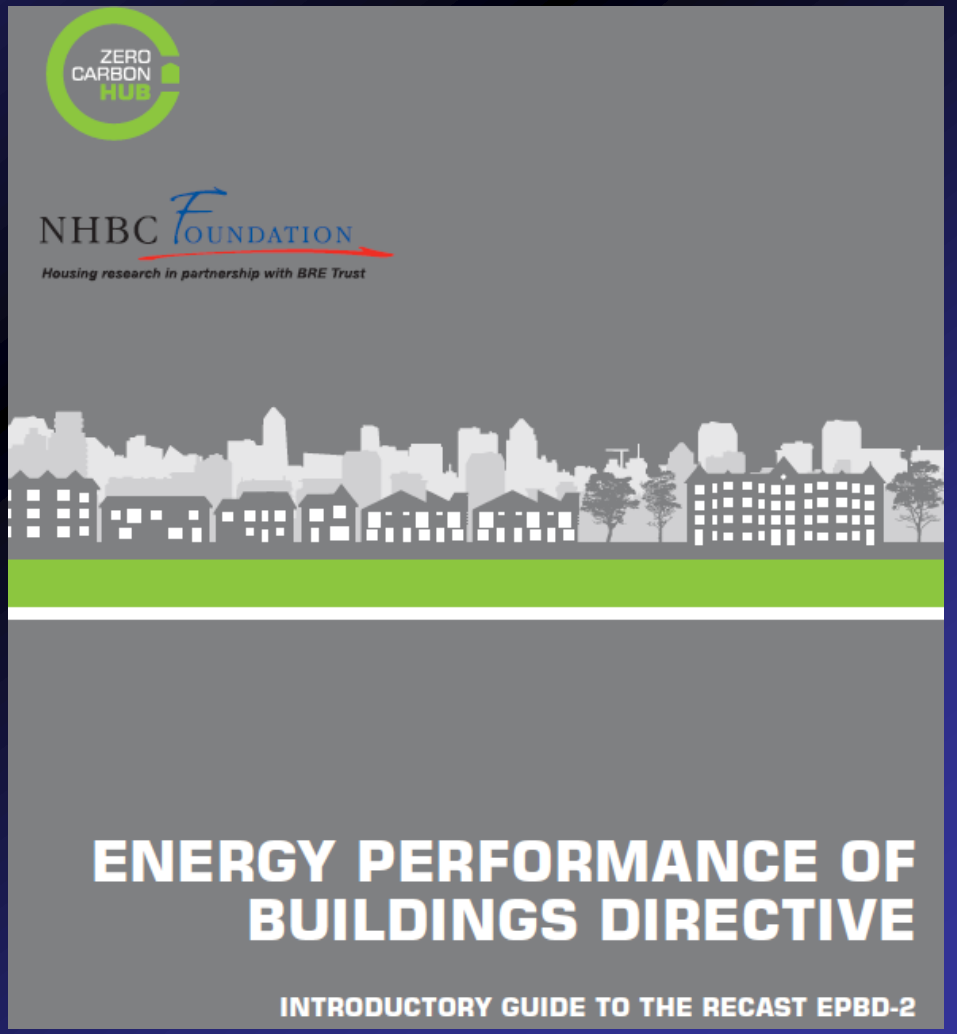
SKID Heat exchanger & Meter

- The App is designed to be user friendly, straightforward and easy to use. The increasing consumer use of Apps means users tend to navigate through the menus intuitively
- Home Screen - The prepay system uses a Home "Meter Screen" which updates the consumer balance. From this central page we offer 9 screens including the nearest place to buy a top-up and the consumers barcode which is given to the retailer during the top-up process. We use a colour coded system for top-up and supporting data.
- Arrears tool While there will not be arrears in the prepay system, however arrears collection from the legacy billing system can be facilitated with three strategies capable of being offered; time based daily or a weekly charge; a top-up based or hybrid of the two.

The Future ??
Where are we going?

EPBD-2 2010

EU Regulations 2012



Reduction of Energy Consumption

- National Energy Efficiency Action Plan (NEEAP 2) to 2020
- Launched 28th February 2013.
- Endorses Europe's energy strategy for 2020
- 20% National Energy Savings target by 2020
- Key Action Plan measures for all sectors of the economy
  - Residential
    - Implement EPBD 2
    - Target those in Energy Poverty
    - Encourage low or Zero Energy Housing on a voluntary basis from 2013
- NEEAP 2013 available on www.dcenr.gov.ie

EPBD-2 “Directive 2010/31/EU”

- Recast EPBD requires that energy efficient standards be set at Cost Optimal Levels for new buildings and buildings undergoing major renovation
- Cost Optimal Level means the energy performance level which leads to the lowest cost during the estimated Economic Lifecycle, taking into account energy related investment costs, maintenance, operating and disposal costs.
- S.I. 243 of 2012 European Union (Energy Performance of Buildings) Regulations, 2012 makes provisions for the inclusion of BER information in property sale and rental advertisements. Effective date 9th January 2013

Nearly Zero Energy Roadmap

Part L Dwellings

Timeline		2005	2008	2011	2013-2020
Part L[1]	**% Improvement**	Baseline	40% and renewables requirement	60%	**Nearly Zero Energy Dwellings**
	Primary Energy[1] (Avg Dwelling) kWh/m2/annum	150	90	60	45
	CO2[1] (Avg Dwelling) kg/m2/annum	30	18	12	10
EPBD	**BER** (Avg Dwelling)	B3	B1	A3	A2

Part L Buildings other than Dwellings

Timeline		2005	2013	2018
Part L[1]	**% Improvement**	Baseline	40%	**Nearly Zero Energy Building Standard**

Available form the NHBC Foundation Website. www.nhbcfoundation.org