Thermal insulation

Thermalite offers high levels of performance for wall, floor and below ground constructions, satisfying the requirements of Building Regulations and the needs of builders and designers.

A Thermalite wall solution can exceed the suggested U-Values for Part L 2006, and offers the added benefits of:

- Thermal comfort: The inherent thermal mass of Thermalite blocks prevents overheating in summer, whilst at the same time storing heat and solar gains, dispatching this in colder periods.

  New research shows that this can save significant amounts of energy compared to lightweight timber frame, whilst at the same time providing the homeowner with a comfortable environment all year round.

- Air tightness: Thermalite blocks are highly resistant to the passage of air and have proven results in air seepage tests, see page 36.

- Robustness: Unlike some alternative walling solutions, Thermalite blocks offer long-term durability, in addition to low U-Values.

- Expert technical advice: Hanson's Product Services department offers technical advice on building regulations, including thermal calculations and energy ratings.

Introduction to Part L

After a long period of consultation within the building industry, the final version of the Part L (Conservation of Fuel and Power) document (2005) was released on 16th March 2006 as the instrument for improving the energy performance in all new buildings from 6th April 2006. Headlining these changes has been the aim to improve the energy performance of all new buildings, and alterations or extensions to existing buildings.

The focus of the new regulations has moved away from prescribed U-Values for each element of the building fabric, and now requires a carbon emissions evaluation for the building as a whole. This will involve a substantial improvement in the required U-Values for each building element, which is likely to move within an acceptable range dependent on the type of building and other related energy use solutions.

The new document has been revised into the following four sections:

- Part L1A Work in new dwellings.
- Part L1B Work in existing dwellings.
- Part L2A Work in new buildings other than dwellings.
- Part L2B Work in existing buildings other than dwellings.

The previous version of Part L offered three routes to compliance, The Elemental Method, Target U-Value Method and the Carbon Index Method. These three are now replaced by the DER (Dwelling CO_2 Emission Rate), which is an improved methodology for calculating the energy performance in dwellings.

The Target CO_2 Emission Rate (TER) is the minimum energy performance requirement for new dwellings. It is expressed in terms of the mass of CO_2, in units of kg per m^2 of floor area per year emitted as a result of the provision of heating, hot water, ventilation and internal fixed lighting for a standardised household when assessed using approved licensed calculation tools such as SAP 2005.

The main emphasis for new-builds remains an improvement in the building fabric to reduce heat loss, with a steer clearly towards the specification of innovative measures, including solar collectors and ventilation with heat recovery, where appropriate.
The use of non-fossil fuel heating such as Geothermal and Biomass energies will also improve the energy performance of a dwelling.

Parts L1A: 'Work in new dwellings' and L2B: 'Work in existing dwellings' state that reasonable provision shall be made for the conservation of fuel and power in buildings by means of:

a) Limiting:
i. Heat losses through the fabric of the buildings
ii. Excessive solar gains
iii. Heat gains and losses from pipes, ducts and vessels used for space heating, space cooling and hot water storage.

b) Providing energy efficient and properly commissioned fixed building services with effective controls.

c) Providing to the owner, sufficient information about the building and its building services so that the building can be operated and maintained in such a manner as to use no more fuel and power than is reasonable in the circumstances.

d) Minimising technical risk.

Key aspects of the changes

A summary of the principal changes contained within the revised Approved Document is described below.

For all buildings:

- A significant increase in the thermal insulation performance of the building envelope to be introduced.
- Improving the standard of detail design and workmanship in order to reduce gaps in construction and cold bridging.
- Raising the standard of air-tightness to reduce unnecessary ventilation and including the requirement of air permeability tests to be carried out on all new builds.
- Improving the standard of system insulation (pipework, ducts, etc).

L1A (Work in new dwellings) and L2A (Work in new buildings other than dwellings):

- Avoiding solar overheating.
- Improving the SAP calculation method, removing the Target U-Value, Elemental Method and Carbon Index method, and introducing a new TER (Target CO_2 Emission Rate) to replace the existing methods with a more comprehensive calculator, SAP 2005, which will give a DER (Dwelling CO_2 Emission Rate).
- Improving the requirements for properly setting up and adjusting heating and hot water systems and their controls.
- Improving the requirements for the supply of operating and maintenance instructions with heating and hot water systems.
- Improving performance standards for internal lighting efficiency such as low energy lighting.
- Improving the standard of system insulation (pipework, ducts, etc).
- Raising the standard of air-tightness to reduce unnecessary ventilation and including the requirement of air permeability tests to be carried out on all New Builds.

L1B (Work in existing dwellings) and L2B (Work in existing buildings other than dwellings):

• Limiting heat gains and losses:–

a) Through thermal elements and other parts of the building fabric.

b) From pipes, ducts and vessels used for space heating, space cooling and hot water services.

- Providing and commissioning energy efficient fixed building services with effective controls.
- Providing to the owner, sufficient information about the building and its building services, so that the building can be operated and maintained in such a manner as to use no more fuel and power than is reasonable in the circumstances.

Air permeability

In addition to the increase of the required U-Values, the new regulations recommend that the air permeability limits be set at 10$m^3/hr/m^2$ (at 50 pascals pressure). Thermalite blocks have a microcrystalline cellular structure that is highly resistant to the passage of air; these impressive performance levels are confirmed by independent tests undertaken by BSRIA, detailed below:

Report 15055A/1

100mm Thermalite Shield blocks 0.1m^3. hr-1. m^{-2} with acrylic sealed joints.

100mm Thermalite Shield blocks 0.1m^3. hr-1. m^{-2} thin layer mortar joints.

Report 15919A

100mm Thermalite Turbo blocks 0.18m^3. hr-1. m^{-2} with acrylic sealed mortar joints.

Report 16918A

100mm Thermalite Turbo blocks 0.22m^3. hr-1. m^{-2} with acrylic sealed mortar joints.

100mm Thermalite Turbo blocks 1.04m^3. hr-1. m^{-2} with standard mortar joints.

The conclusion can be drawn, that when used as recommended, thin layer mortar joints offer a higher level of sealing performance than standard mortar joints.

Thermal insulation

Thermalite success with air seepage tests

Thermalite products have achieved success in recent air seepage tests carried out by leading house builder David Wilson Homes. Using Thermalite aircrete blocks throughout the inner leaf of a cavity wall, the houses all achieved less than the required airflow rate of less than 10m^3/hm^2, tested at 50 pascals. These plots, constructed in traditional mortar, returned results that ranged from 2.60m^3/hm^2 to 8.81m^3/hm^2, with the highest figure recorded for an uncompleted house.

Plot number	Airflow rate
104	2.60m^3/hm^2
137	8.81m^3/hm^2
140	3.96m^3/hm^2
143	5.90m^3/hm^2

Solar gain

As required by Part L1 (a) (ii), provisions should be made to limit internal temperature rise due to solar gains. This can be done by an appropriate combination of window size and orientation, solar protections through shading and other solar control measures, ventilation (day and night) and high thermal capacity. CE129 Reducing Overheating – A Designers Guide, offers guidance on strategies to control overheating.

Other requirements for dwellings

Poorest acceptable U-Values

Since there are no longer prescribed constructions that can assure compliance with Part L 2006, it is reasonable to assume that U-Values in the range listed below will prove acceptable for the new standards under the majority of situations. For details of Thermalite wall solutions to meet 0.30$W/m^2.K$ and 0.27$W/m^2.K$, please refer to the tables on pages 38-41.

Walls
0.30$W/m^2.K$ to 0.27$W/m^2.K$
Floors
0.22$W/m^2.K$ to 0.20$W/m^2.K$
Roof (horizontal ceiling)
0.16$W/m^2.K$ to 0.13$W/m^2.K$
Windows & doors
1.8$W/m^2.K$ to 1.5$W/m^2.K$

The parameters will generally assume gas to be the primary heating source, a boiler SEDBUK of no less than 86% and the air-tightness default of 10$m^3/hour/m^2$.

The use of non-fossil fuel heating such as Geothermal and Biomass energies will improve the energy performance of a dwelling and assist in achieving a DER (Dwelling CO_2 Emission Rate) v TER (Target CO_2 Emission Rate) pass, while inefficient carbon fuel such as oil, LPG and electricity will likely require further improvements within the build, such as improved U-Values within elements and or the use of zero carbon technology such as solar, to achieve a DER v TER pass.

Low and zero carbon systems

When using low or zero carbon technologies as mentioned above, there are new technical references from the Department for Communities and Local Government (DCLG) that give guidance on ways of complying when providing heating and hot water services systems and full information of the benefits of these zero carbon technologies, such as Geothermal and Biomass.

For further information, please refer to:
www.communities.gov.uk

Poorest acceptable SEDBUK (standard efficiency of domestic boilers in the UK)

From April 2005 the following changes to the SEDBUK efficiency has been altered to the following as minimum value.

Mains natural gas 86%, **LPG** 86%, **Oil** 85%
Oil combi boiler 82%

Heating and hot water system controls

For systems incorporating hot water storage, specific levels of insulation are required, as well as efficient control and performance specification. Reasonable provision must also be made to insulate pipes and ducts.

Internal and external lighting systems

A way of showing compliance would be to provide lighting fittings (including lamp, control gear and an appropriate housing, reflector, shade or diffuser or other device for controlling the output light) that only take lamps having a luminous efficiency greater than 40 lumens per circuit-Watt. Circuit-Watts means the power consumed in lighting circuits by lamps and their associated control gear and power factor corrections equipment, fixed energy efficient light fittings that number not less than:

a) One per 25m^2 of dwelling floor area (excluding garages) or part thereof
or
b) One per four fixed lighting fittings.

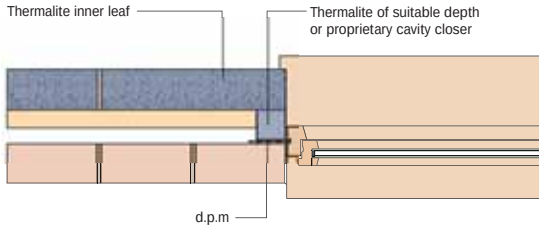
Limiting thermal bridging at junctions and around openings

The building fabric should be constructed to avoid significant thermal bridges and gaps in insulation layers in the various elements of the fabric, at joints between the various elements and at the edges of elements such as those around window and door openings.

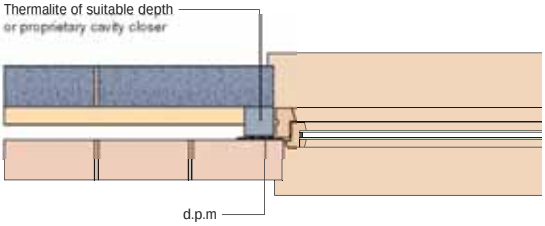
To meet the requirements of Part L, the following minimum depths of cut Thermalite (excluding mortar), of width matching that of the inner leaf block will comply*:

Turbo 50mm, **Shield** 68mm, **Party Wall** 72mm

The window frame should overlap the closer block by a minimum of 30mm, (see Detail 1. left) and in very severe exposure zones, the masonry should be rebated, (see Detail 2 below).



Detail 1 Window frame overlapping cavity closer – flush reveal



Detail 2 Window frame overlapping cavity closer – rebated reveal for very severe exposure zones

*See note on page 64

Please contact the DCLG for more information.

Fixed external lighting means lighting fixed to an external surface of the dwelling supplied from the occupier's electrical system.

Provision should be made to enable effective control and/or the use of efficient lamps such that:

a) Either: Lamp capacity does not exceed 150W per light fitting and the lighting automatically switches off:
i. When there is enough daylight.
ii. When it is not required at night.
or
b) The light fittings have sockets that can only be used with lamps having efficiency greater than 40 lumens per circuit-Watt.

Conservatories

Together with a definition, clear guidance is given on conservatories which are attached to dwellings and dependent on how they are connected to the dwelling, provides ways of achieving compliance.

Wall ties

The type and number of wall ties can have a significant effect on the U-Values due to thermal bridging of the cavity and insulation and must be considered in the calculation of all U-Values. Information can be gained from your wall tie manufacturer or from a qualified energy assessor.

Thermal insulation

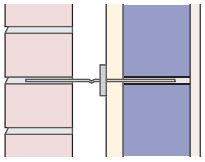


Table 1- Partially filled cavity

Using insulation type: PIR - Polyisocyanurate/Celotex/Kingspan/Xtratherm 0.023W/m.K

General purpose mortar joints (10mm)

Insulation thickness	Turbo 100mm	Turbo 150mm	Shield 100mm	Shield 150mm	Hi-Strength 7 100mm	Hi-Strength 7 150mm
25mm	-	-	-	-	-	-
35mm	0.30	0.27	-	0.29	-	0.30
40mm	0.28	0.26	0.30	0.27	0.30	0.28
45mm	0.26	0.24	0.28	0.26	0.28	0.26
50mm	0.25	0.23	0.26	0.24	0.27	0.25
25mm	-	-	-	-	-	-
35mm	-	0.28	-	0.30	-	-
40mm	0.29	0.26	0.30	0.28	-	0.29
45mm	0.27	0.25	0.28	0.26	0.29	0.27
50mm	0.26	0.23	0.27	0.25	0.28	0.26

Thin layer mortar (<3mm)

Turbo 100mm	Turbo 150mm	Shield 100mm	Shield 150mm	Hi-Strength 7 100mm	Hi-Strength 7 150mm
-	0.29	-	-	-	-
0.29	0.25	-	0.28	-	0.30
0.27	0.24	0.29	0.26	0.30	0.28
0.25	0.23	0.27	0.25	0.28	0.26
0.24	0.22	0.26	0.24	0.26	0.25
-	0.30	-	-	-	-
0.30	0.26	-	0.29	-	-
0.28	0.25	0.30	0.27	-	0.29
0.26	0.24	0.28	0.26	0.29	0.27
0.25	0.22	0.26	0.24	0.27	0.25

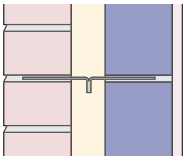


Table 2 - Fully filled cavity

Using insulation type: mineral wool 0.033W/m.K

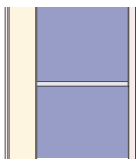
General purpose mortar joints (10mm)

Insulation thickness	Turbo 100mm	Turbo 150mm	Shield 100mm	Shield 150mm	Hi-Strength 7 100mm	Hi-Strength 7 150mm
65mm	-	0.28	-	0.30	-	-
75mm	0.29	0.26	0.30	0.28	-	0.29
85mm	0.26	0.24	0.28	0.26	0.28	0.27
90mm	0.26	0.23	0.27	0.25	0.27	0.26
100mm	0.24	0.22	0.25	0.23	0.25	0.24
65mm	-	0.29	-	-	-	-
75mm	0.30	0.27	-	0.29	-	0.30
85mm	0.27	0.25	0.29	0.26	0.29	0.28
90mm	0.26	0.24	0.27	0.25	0.28	0.27
100mm	0.24	0.22	0.25	0.24	0.26	0.25

Thin layer mortar (<3mm)

Turbo 100mm	Turbo 150mm	Shield 100mm	Shield 150mm	Hi-Strength 7 100mm	Hi-Strength 7 150mm
0.30	0.27	-	0.29	-	-
0.28	0.25	0.30	0.27	-	0.28
0.26	0.23	0.27	0.25	0.28	0.26
0.25	0.22	0.26	0.24	0.27	0.25
0.23	0.21	0.24	0.22	0.25	0.23
-	0.28	-	0.30	-	-
0.29	0.26	-	0.28	-	0.29
0.26	0.24	0.28	0.26	0.29	0.27
0.25	0.23	0.27	0.25	0.28	0.26
0.24	0.21	0.25	0.23	0.26	0.24

Table 3 - Solid wall



General purpose mortar joints (10mm)

Insulation thickness	Turbo 215mm	Turbo 265mm	Turbo 300mm	Shield 190mm	Shield 200mm	Hi-Strength 7 200mm	Hi-Strength 7 215mm
16mm render	-	-	-	-	-	-	-
	-	0.28	0.26	-	-	-	-
	0.27	0.25	0.23	-	-	-	-
	0.24	0.22	0.21	0.27	0.27	0.28	0.28
	0.27	0.25	0.23	-	-	-	-
	0.24	0.22	0.21	0.27	0.27	0.28	0.28
	0.26	0.24	0.22	-	-	-	-
	0.23	0.21	0.20	-	-	-	-
Tile hanging insulation external	0.28	0.25	0.24	-	0.30	-	-
	0.25	0.23	0.22	0.29	0.28	0.30	0.30
Wonderwall	0.23	0.22	0.22	0.26	0.26	0.27	0.27
	0.24	0.22	0.22	0.27	0.27	0.28	0.28

Thin layer mortar (<3mm)

Turbo 215mm	Turbo 265mm	Turbo 300mm	Shield 190mm	Shield 200mm	Hi-Strength 7 200mm	Hi-Strength 7 215mm
-	0.29	0.27	-	-	-	-
0.29	0.25	0.24	-	-	-	-
0.25	0.23	0.21	0.30	0.30	-	-
0.22	0.20	0.19	0.26	0.26	0.27	0.27
0.25	0.23	0.21	0.30	0.30	-	-
0.22	0.20	0.19	0.26	0.26	0.28	0.28
0.24	0.22	0.20	0.28	0.28	-	-
0.21	0.20	0.19	0.25	0.24	-	-
0.26	0.23	0.22	-	-	-	-
0.24	0.21	0.20	0.28	0.27	0.29	0.29
0.22	0.20	0.19	0.25	0.25	0.27	0.26
0.23	0.20	0.19	0.26	0.26	0.28	0.27

Finish
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster

Please note that this table assumes a resistance figure of 0.64m^2.K/W for the clear cavity space of no smaller than 25mm.

Finish
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster

Finish
30mm Lafarge Thermalcheck K board on dabs
40mm Lafarge Thermalcheck K board on dabs
50mm Lafarge Thermalcheck K board on dabs
60mm Lafarge Thermalcheck K board on dabs
50mm Gyproc Thermaline Super board on dabs
60mm Gyproc Thermaline Super board on dabs
42.5mm Kingspan Kooltherm K17 insulated drylining
52.5mm Kingspan Kooltherm K17 insulated drylining
40mm insulation laid between battens PIR 0.023W/m.K with 12.5mm plasterboard
50mm insulation laid between battens PIR 0.023W/m.K with 12.5mm plasterboard
12.5mm plasterboard on dabs
13mm light weight plaster

The effect of thin joint masonry

The use of Thermalite Thin Layer Mortar, with a bed joint thickness of approximately 2.5mm, can provide a significant contribution to improving the overall U-Value of a masonry wall without the need to increase the amount of insulation.

This is seen at its most effective in solid wall constructions, as shown in Table 3.

For cavity constructions, whilst the contribution to improved thermal performance of thin layer mortar is less than that for the solid walls, useful improvements on U-Values can be gained, in addition to the air tightness benefits offered by thin joint construction.

Thermal mass

The inherent thermal mass of Thermalite blocks helps to achieve a comfortable room temperature, preventing overheating in summer, whilst at the same time storing heat and solar gains and dispatching this in colder periods. New research has showed that conventional masonry houses that take advantage of their inherent thermal mass can save a significant amount of energy over their lifetime, compared to lightweight timber frame houses.

The thermal mass of masonry homes reduces the need for air conditioning, which is particularly relevant in terms of the predicted increase in global temperature in the 21st century. Additional savings can also be achieved through passive solar design, reducing the consumption of winter heating fuel.

These savings can offset the slightly higher level of embodied CO_2 in a masonry house over as little as ten years, and lead to a lower whole life CO_2.

Specific heat capacity

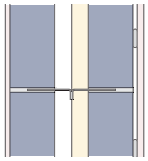
The mean specific heat capacity of dry Thermalite over the temperature range 20° - 100° is 1.05kJ/kg°C.

Thermal insulation

Please note that this table assumes a resistance figure of 0.644m².K/W for the clear cavity space of no smaller than 25mm.
All external leaves are to be 100mm Thermalite Shield with a rendered finish.

Table 4 - Block-to-block partially filled cavity

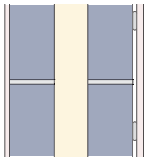
Using insulation type: PIR - Polyisocyanurate/Celotex/Kingspan/Xtratherm 0.023W/m.K



	General purpose mortar joints (10mm)						Thin layer mortar (<3mm)					
Insulation thickness	Turbo 100mm	Turbo 150mm	Shield 100mm	Shield 150mm	Hi-Strength 7 100mm	Hi-Strength 7 150mm	Turbo 100mm	Turbo 150mm	Shield 100mm	Shield 150mm	Hi-Strength 7 100mm	Hi-Strength 7 150mm
25mm	0.30	0.27	-	0.29	-	0.30	0.28	0.25	0.30	0.27	-	0.29
35mm	0.26	0.24	0.27	0.25	0.28	0.27	0.25	0.23	0.26	0.24	0.27	0.26
40mm	0.25	0.23	0.26	0.24	0.27	0.25	0.24	0.22	0.25	0.23	0.26	0.24
45mm	0.23	0.22	0.24	0.23	0.25	0.24	0.22	0.20	0.24	0.22	0.24	0.23
50mm	0.22	0.22	0.23	0.22	0.24	0.23	0.21	0.20	0.23	0.21	0.23	0.22
25mm	-	0.28	-	0.30	-	-	0.29	0.26	-	0.28	-	0.30
35mm	0.27	0.25	0.28	0.26	0.29	0.27	0.26	0.23	0.27	0.25	0.28	0.26
40mm	0.26	0.23	0.27	0.25	0.28	0.26	0.24	0.22	0.26	0.24	0.27	0.25
45mm	0.24	0.22	0.25	0.24	0.26	0.24	0.23	0.21	0.24	0.23	0.25	0.24
50mm	0.23	0.21	0.24	0.22	0.25	0.23	0.22	0.20	0.23	0.22	0.24	0.23

Table 5 - Block-to-block fully filled cavity

Using insulation type: mineral wool 0.033W/m.K



	General purpose mortar joints (10mm)						Thin layer mortar (<3mm)					
Insulation thickness	Turbo 100mm	Turbo 150mm	Shield 100mm	Shield 150mm	Hi-Strength 7 100mm	Hi-Strength 7 150mm	Turbo 100mm	Turbo 150mm	Shield 100mm	Shield 150mm	Hi-Strength 7 100mm	Hi-Strength 7 150mm
50mm	-	0.24	-	0.30	-	-	0.30	0.26	-	0.29	-	0.30
65mm	0.27	0.22	0.29	0.27	0.30	0.28	0.26	0.23	0.28	0.25	0.29	0.27
75mm	0.25	0.20	0.27	0.25	0.27	0.26	0.24	0.22	0.26	0.24	0.26	0.25
85mm	0.24	0.19	0.25	0.23	0.25	0.24	0.23	0.21	0.24	0.22	0.24	0.23
90mm	0.23	0.19	0.24	0.22	0.24	0.23	0.22	0.20	0.23	0.21	0.24	0.22
100mm	0.21	0.18	0.22	0.21	0.23	0.21	0.20	0.19	0.21	0.20	0.22	0.21
50mm	-	0.29	-	-	-	-	-	0.27	-	0.30	-	-
65mm	0.28	0.26	0.30	0.28	-	0.29	0.27	0.24	0.29	0.26	0.30	0.28
75mm	0.26	0.24	0.27	0.24	0.28	0.26	0.25	0.22	0.26	0.24	0.27	0.25
85mm	0.24	0.22	0.25	0.23	0.26	0.25	0.23	0.21	0.24	0.23	0.25	0.24
90mm	0.23	0.22	0.24	0.23	0.25	0.24	0.22	0.20	0.24	0.22	0.24	0.23
100mm	0.22	0.20	0.23	0.21	0.23	0.22	0.21	0.19	0.22	0.21	0.23	0.21

Finish
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster

Finish
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
12.5mm plasterboard on dabs
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster
13mm light weight plaster