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Alternatives to Glass Mineral Wool

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Summary

Glass wool has a number of applications as an insulation material in the construction, building services and process industries. It is used in the construction industry primarily for thermal insulation, either in roll, slab or batt form or as a blown material for cavity fill. A number of alternative materials exist within the temperature range -20°C to +100° C, notably stone wool and plastic products.

Glass wool is used in the construction industry, predominantly as an insulation material in the roof, primarily in the loft area of buildings in 'cold roof' applications. In addition to loft insulation, glass wool is used as cavity wall fill, either as blown material or in batt form. Glass wool may be used as a thermal or acoustic insulator in both process and construction industries. The thermal and, when compacted to the same density, acoustic properties of both glass wool and stone wool are very similar.

Glass wool is favoured as loft insulation due to its light weight and ease of handling, good thermal insulation and low cost. Stone wool is more expensive than glass wool for this application, though it offers very similar thermal insulation properties.

Installers of retro fit blown cavity wall insulation appear to favour glass wool as it is less harsh on the delivery equipment than stone wools, although stone wool appears to be widely used in post construction cavity wall insulation in new buildings. Foamed, extruded and beaded plastics are alternatives materials for cavity wall insulation. Generally on the UK mainland the alternatives to mineral wools find it difficult to compete on price and convenience to builders, specialist insulation installers and householders. Stone wool is comparable in price with glass wool in England and Wales, and appears to be competitive for large house builders in appropriate locations. It offers very similar thermal insulation properties. Plastic materials with similar thermal conductivity characteristics to mineral wools, such as EPS beads tend to be marginally more expensive, except in Northern Ireland.

For built in cavity wall insulation, plastic materials with thermal conductivity characteristics superior to mineral wools, such as PIR and PUR, tend to be much more expensive. A further change in Building Regulation insulation requirements is likely to see increased movement away from mineral fibre to plastic foams with improved insulating properties.

Results of a survey of insulation installation companies conducted as part of this study indicate that a significant rise in the price of glass wool, in excess of 10%, or a major change in the Building Regulations thermal insulation requirements, would be necessary before installers move to alternative forms of loft insulation. Installers with dedicated glass wool blowing machines also expressed the view that the cost of glass wool would need to exceed 10% before they considered moving to alternative materials. The CC survey of house builders indicates widespread use of plastic insulation materials for new build cavity wall insulation. Builders of new houses are governed by the NHBC standards and in areas of severe exposure to wind driven rain, the more thermally efficient partial fill materials are now generally used.

There is currently insufficient mineral wool manufacturing capacity in the UK to meet present demands for insulating material and manufacturers have introduced a quota basis for the supply of some customers. Given the anticipated tightening of new build requirements in 2006, the current supply situation will deteriorate until new capacity can be brought on stream. Significant technical and financial barriers exist to possible new entrants in the glass wool manufacturing field.

1 Introduction

1.1 Terms of Reference

On 17 June 2004, the OFT referred the anticipated acquisition of Superglass Insulation Limited by Knauf Insulation Limited to the Competition Commission for investigation. Both companies produce glass wool for thermal insulation in both retro-fit and new build cavity walls, lofts and other applications. Knauf also produces stone wool.

This report has been provided at the request of the Competition Commission. The Terms of Reference are included at Appendix A and include:

- Technical parameters which are significant in the choice of material, identifying where substitution is technically possible between glass wool and stone wool, and between mineral wool (which includes both glass wool and stone wool) and other materials.
- Legislative and regulatory requirements.
- Considerations bearing on well informed decisions on material choice.
- Cost implications.

The scope of the report is largely restricted to the substitution of glass wool by other materials**.**

These Terms of Reference are addressed as follows:

- Section 1 introduces the report.
- Section 2 addresses the manufacture, technical properties and applications of glass mineral wool together with the status and prospects of alternative insulating products.
- Section 3 addresses the uses of glass wool.
- Section 4 discusses the influences affecting the selection of materials for a particular application.
- Section 5 considers the factors affecting the ability of customers to change between the various blown mineral wool products.
- Section 6 discusses the current industry capacity and possible barriers to entry of new producers and includes consideration of the factors affecting the ability of producers to switch between the manufacture of different products.
- Section 7 summarises technical and regulatory requirements.
- Reference material is presented in Appendices A to E.

1.2 Reference Documentation

Reference has been made to the following documentation in the preparation of this report:

- Competition Commission Guidelines.
- Competition Commission Staff Papers.
- Submissions made to the Commission by Knauf Insulation Ltd. and Superglass Insulation Ltd.
- Submissions made to the Commission by other interested parties.
- A questionnaire sent by the Commission to major house builders.
- Technical and trade literature within the public domain.
- Mott MacDonald in-house technical documentation.

1.3 Units of Measurement, Glossary and Abbreviations

1.3.1 Units of Measurement

- Thickness of insulation is measured in millimetres (mm).
- Overall dimensions of buildings are measured in metres (m).
- Thermal conductivity = W/mK (k).
- Thermal resistance = thickness (m) x 1/k = R.

1.3.2 Glossary and Abbreviations

- **Batt**: A semi rigid block of insulation material, covered on one or two faces with a thermal reflective coating.
- **Curtain walling:** A lightweight cladding system comprising windows and architectural panels to clad the external elevations of buildings.
- **Mansard**: A double pitch roof with the lower pitch varying between 60° and 70° and the upper between 30° and 40°.
- **Matt**: A low density flexible sheet, nominally in roll form, of insulation material.
- **Portal frame**: A frame (usually of steel or concrete) comprising two columns connected at the top by a third member.
- **Rainscreen**: A cladding system to allow the ingress of air at the base and the egress of air at the top. The cavity allows any water penetrating the panel joints to be partly removed by the ‘stack effect’ and partly by running down the rear face of the panels and out of the base.
- **Roll**: A wound roll of insulation material usually compressed to reduce volume.
- **Slab**: A high density rigid block of insulation material used in the HVAC industry for duct insulation.

1.3.3 Abbreviations

BSI	British Standards Institute
BRE	Building Research Establishment
CC	Competition Commission
DIY	Do-it-yourself
EEMUA	Engineering Equipment and Material Users Association
EU	European Union
ENR	Expanded nitrile rubber
EPS	Expanded polystyrene
XPS	Extruded polystyrene
PUF	Flexible polyurethane
HVAC	Heating, ventilation and air-conditioning
mm	Millimetre(s)
MM	Mott MacDonald
NHBC	National House Building Council
OFT	Office of Fair Trading
PIR	Rigid polyisocyanurate
PUR	Rigid polyurethane
RMI	Repair, maintenance and improvement work
UF	Ureaformaldehyde

2 Glass Wool and Alternatives

2.1 Insulating Materials

Insulating materials are used for thermal insulation, acoustic insulation and passive fire protection (fireproofing) in a wide range of applications. There is a great diversity of insulating products manufactured from a number of different materials to suit a very wide range of applications. There is no single product or product type and the same materials may be available in different forms and with different properties to suit different applications.

For many applications, insulating materials are used in conjunction with other materials. These may include, for example, decorative finishes or physical protection such as aluminium cladding to pipe sections. They may also be used in conjunction with a number of other materials to form a single structural system such as those adopted for many types of roofing.

Materials used for insulation and fire protection include:

(a) mineral wools (inorganic), for example: glass, stone or ceramic fibre wool.

(b) other inorganic materials, for example: foam glass, calcium silicate, microporous silica, magnesia, vermiculite, perlite.

(c) foams (organic), for example: extruded polystyrene foam, expanded polystyrene foam, polyurethane, polyisocyanurate and phenolic foam, polyethylene foam, expanded nitrile rubber.

(d) other organic materials, for example: rigid expanded PVC, cork and wood products.

Applications for these materials are diverse and varied and include new construction, manufacture, refurbishment, repair and maintenance within the following sectors:

(a) buildings (domestic, industrial and commercial);

(b) heating and ventilation systems;

(c) original equipment manufacturers, for example domestic, transport; and

(d) equipment, ducts and pipework for process plant in the petrochemical, power, marine, manufacturing and food processing industries. Process plant applications include a particularly wide variety of equipment, pipe/duct sizes and shapes and temperatures.

Requirements within each sector vary and no one sector is dominated by materials of a particular type or form.

2.2 Mineral Wools

There are generally three categories of mineral wool according to maximum temperature endurance. These are glass wool (230° to 250°C), stone wool (700° to 850°C) and ceramic fibre wools (1200°C). The temperatures quoted reflect manufacturers' normal recommendations for standard products.

This report considers glass wool, as it is the product produced by both parties in the proposed merger. For the applications in which glass wool is used, the main alternatives are stone wool and plastic foams. Ceramic fibre wool is a high cost specialist niche material finding applications associated with very high temperature outside the scope of this report.

Glass wool and stone wool are similar in that they consist of fine fibres which are formed from molten raw material at a high temperature. Binders are used during manufacture to enhance the physical characteristics of the fibres which are then made into rigid slabs, flexible quilts or pre-formed rigid sections. In addition, additives enhance the performance of finished products, for example by assisting in the reduction of heat gain which may occur during the first heating after installation.

Mineral wools may be bonded to other materials such as plasterboard or sheet metal to form products with specific properties. The properties of mineral wool products may be adjusted by including variations in one or more of the following: density, binder type and quantity, thickness and facing. Care must therefore be taken in comparing costs to ensure that a like-for-like technical comparison is being made. Raw price comparisons on a £/m², £/m³ or £/tonne basis must be evaluated according to context.

The fundamental difference between stone wool and glass wool is that the main constituent of stone wool is volcanic rock rather than glass. The manufacture of stone wool requires a furnace temperature of around 2,000°C. The manufacture of glass wool requires a furnace temperature of around 1,400°C. Binding agents are added during the manufacturing process.

Stone wool is inherently able to resist higher application temperatures than glass wool and generally has a greater fire resistance. The acoustic attenuation properties of the two materials are similar and both products are used for this application.

The maximum limiting temperature of both these materials is not a fixed value but depends on the specific properties of an individual product. The physical integrity of the fibres reduces gradually as the limiting temperature of the binding agent and the softening point of the fibre material are approached. Thus the maximum temperature which may be applied to one stone wool or glass wool product may not be the same as the maximum application temperature of another product of the same material.

Ultimately, the maximum temperature of any installation will be determined by the point at which the base material devitrifies, i.e. the point at which the material has softened to the extent that physical integrity is compromised. Stone wool reaches this point at around 850°C, glass wool at around 550°C.

For any particular product, the maximum sustainable operating temperature is dependent on the material properties of the constituents of the specific product under consideration, including the type and quantity of both binder and additives, each of which may be adjusted during production to suit particular requirements. Typically, the maximum operating temperature is quoted in the region of 700°C to 800°C for stone wool products and 230°C to 250°C for glass wool products. However one manufacturer of glass wool offers material with a maximum temperature limit of 500ºC subject to special order in his technical brochure.

Glass wool and stone wool are both generically described as ‘open cell air filled insulants’ as opposed to many plastic insulation materials which tend to have ‘closed cell’ structures. The Table below summarises some of the key properties for glass and stone mineral wools with indicative values.

Material	Approx. Max Operating Temperature ºC	Range of Bulk Density kg/m³	Range of Thermal Conductivity W/m.K	Physical Forms	Type of Structure
Glass Mineral Wool	230 to 250	9 to 120	0.032 to 0.040 (At 20ºC)	Pre formed pipe sections, rigid batts, flexible matts	Open cell
Stone Mineral Wool	700 to 850	23 to 200	0.033 to 0.035 (At 10ºC)	Pre formed pipe sections, rigid batts and flexible matts	Open cell

2.3 Alternative Plastic Foam Products

There are a number of alternative plastic foam materials used by the building industry for various applications. The table below lists materials with their key properties which are used in significant quantities either in competition with, or in preference to, mineral wools.

Material	Approx Max Operating Temperature ºC	Range of Bulk Density kg/m³	Range of Thermal Conductivity W/m.K at 20ºC	Physical Forms	Type of Structure
EPS Expanded Polystyrene	80	15 to 30	0.033 to 0.040 (10ºC)	Loose beads, pre-formed bead board	Closed cell
XPS Extruded Polystyrene	80	15 to 35	0.025 to 0.033 (10ºC)	Pre-formed slabs, pre-formed pipe sections	Closed cell
PUR Rigid Polyurethane	110	30 to 160	0.023	Slabs, pipe sections, sprayed	Closed cell
PIR Rigid Poly-isocyanurate	140	30 to 60	0.023	Slabs, pipe sections, sprayed	Closed cell
Phenolic Foam	120	35 to 160	0.020 to 0.036	Pre-formed slabs, pre-formed pipe sections	Closed cell
ENR Expanded Nitrile Rubber	105	60 to 100	0.040	Flexible pre-formed pipe sections, flexible slabs and rolls	Closed cell
Polyethylene Foam	80	30 to 40	0.040	Pre-formed pipe sections	Closed cell

For maximum temperature the table above shows that plastic foams are limited to around 80 deg C to 140 deg C according to the specific material.

Regarding thermal insulation performance, the table shows that PUR, PIR and Phenolic foams can offer superior properties compared to mineral wools resulting in thinner sections required for given applications. For example, these products can offer a partial fill cavity wall solution for new build whereas the equivalent mineral wool design has to be full fill on account of the higher thermal conductivity of mineral wool. For a more complete discussion on partial fill and full fill see 3.2.2 Cavity Wall Insulation below.

Plastic foam products in general have significantly lower fire resistance compared to mineral wools. The recent Euroclass Classifications tests which identify the tendency of a material to avoid flashover are likely to categorise insulation materials as follows (source EURISOL website: www.ima-eu.org)

- Class A1 and A2 (Non combustible – Avoid flashover)
  - Glass and Stone Mineral Wool.
- Class C, D, E, F (Fail or no performance determined – Promote flashover)
  - Phenolic Foam (C)
  - EPS type A, PIR faced, XPS (D)
  - Polyisocyanurate sprayed (E)
  - EPS type N (F).

Even though the new Euroclasses may give a pessimistic picture for plastic foam materials it should be noted that the respective foam materials which are used in the building industry meet the necessary requirements of the UK Building Regulations when tested under the relevant British Standard tests.

Whereas fire properties of plastic foams are relatively poor, the inherent characteristic of closed cell structure of the more extensively used plastic foams produces superior vapour permeance properties compared to mineral wools. Mineral wools have to be provided with foil facing or other non permeable facing to achieve the required equivalence.

3 Uses of Glass Wool

3.1 Overview

Glass wool is used extensively in the building construction industry primarily for thermal insulation purposes followed by second order applications in acoustic attenuation and passive fire protection. In the industrial sector, glass wool finds some applications for thermal insulation of both process pipework, vessels and tanks and HVAC systems within temperature limitations.

The list below provides an overview of applications in the domestic, commercial and industrial building construction sector.

- Roof Insulation (pitched and flat)

    - Cold Roof (Loft Insulation)

    - Warm Roof

    - Flat Roof

- Cavity Wall
- Flooring
- Industrial/Commercial Buildings
- Specialist Applications
- Fire Protection and Sound Insulation

3.2 Domestic Building Construction

For domestic building construction applications, the various applications are reviewed below according to ranking of market share (by area).

- Roof Insulation (pitched and flat)
- Cavity Wall
- Flooring

3.2.1 Roof Insulation

There are two approaches to insulating the roof area of a building: cold roof and warm roof. The concepts equally apply to both new build and retro-fit applications. For a cold roof, insulation is applied between and over the ceiling joists, the total area of insulation is smaller, the insulation can be unrolled and laid flat and thus does not require any additional support. Generally the cold roof approach is the most common in the new build and retro-fit sectors because it uses less material and is less labour intensive than the warm roof approach. A housing developer may provide minimal necessary access to plumbing systems in the roof and ignore possible future use of the loft space.

The general trend in required insulation thickness over the years, as reflected in the Building Regulations, has increased significantly as illustrated by the table below for typical glass wool product for cold roof application:

Year	Approximate Thickness (mm)
1950	0
1965	25
1975	100
1985	150
1995	200
2002	250
2003	270

It can be seen that the requirements of the Building Regulations have increased the demand for insulation products and have shifted the emphasis from cold roof to warm roof where loft space is required to be maintained by householders for storage. The March 2004 edition of The Market for Building Insulation, published by Construction Markets, stated that, “There has been a gradual trend to rafter level insulation (warm roofs) over the last few years…” Current requirements for around 270 mm thickness of insulation part between and then part above the joists effectively precludes the use of the loft space for storage for a cold roof application for new build houses.

The use of a thinner layer of a better insulator such as phenolic based materials was discussed with the BRE at Garston. It was agreed that, although a reduction could be achieved in the depth of insulation, the practicalities of achieving this would use high cost materials and be labour intensive in installation. This was also discussed with insulation installation contractors, who substantiated the BRE views.

In the new build market, builders generally dictate the loft insulation system e.g. the cheapest to satisfy Building Regulation requirements and planning conditions. In the retro-fit market, unless the building is subject to conversion, there is no need to retrospectively comply with Building Regulation requirements and insulation will be installed at the convenience of the householder (or installer).

Although glass mineral wool matt is the main material used for cold roof loft insulation, stone mineral wool also records a modest position in the market. This is largely attributable to the Do-it-yourself (DIY) sector where products of equivalent performance are available on a price competitive basis from different leading DIY chains of stores. In its survey of major house builders, the CC found that glass wool was almost always quoted as the preferred method.

Warm roof insulation is applied between the rafters. In the case of mineral wools, this will mean using 20% additional material (by area) for a 30° pitched roof. In order to fit the insulating material between rafters, the insulation will need to be in a board form with boards, batts or mats cut to suit the spacing of rafters and supported to prevent collapse of the insulation. This approach to insulation becomes more economical where use is being made of the roof space, such as mansard roofs or rooms in the roof of domestic buildings. As the requirement of the Building Regulations for depth of loft insulation increases, currently approximately 270 mm, it precludes the use of loft space for storage or other purposes. For the warm roof sector the market appears dominated by rigid batt sections of alternative expanded plastic foam products other than glass mineral wool. The dominance of expanded plastic foam products is attributable to the space (in particular depth) available for fitting given the characteristics of an average roof design configuration in current markets. Plastic foam products generally give a reduced thickness compared to mineral wool products for an equivalent design condition. The rigidity provided by plastic foam products also allows a greater ease of installation compared with flexible mineral fibre matts that require installers to wear personal protective equipment. House builders have commented that warm roof, and hence the use of plastic materials in roof insulation, is expected to increase in the new build market.

For flat roof applications the choice of material appears dependant on the requirement for mechanical strength. Over-deck configurations favour alternative plastic foam products and the less significant case of under-deck utilises glass mineral wool.

3.2.2 Cavity Wall Insulation

Cavity wall insulation can be divided into new-build and retrofit applications. For new build applications there are three options available to the constructor. These are:

- Full fill with insulating batts
- Partial fill with insulating batts
- Blown products (mineral wools, expanded foam beads or UFF).

The National House-Building Council (NHBC) has laid down guide lines for the use of cavity insulation in Chapter 6.1 of the NHBC Standards. The map contained in Appendix 6.1-B of the NHBC Standard indicates severe exposure to wind driven rain in areas of Northern Ireland with extensive areas of wind driven rain shown in the South West and North West of England, West Wales and West and Central Scotland. Full cavity fill in areas of severe exposure is not permitted for 'fair faced' brick walls. If full cavity fill were to be considered the wall would need to be clad with an impervious material such as tiling, cladding or render. House builders have suggested that the NHBC would generally prefer to have clear cavities in areas of severe exposure. The NHBC advise against the use of full cavity fill during the time of construction in exposed areas and state that "In Northern Ireland and the Isle of Man it is not permissible to fill the full width of the cavity with pumped insulants, e.g. UF foam, at the time of construction." However, this does not exclude the post construction filling of cavities with EPS beads or blown mineral wools in Northern Ireland and the Isle of Man. "In Scotland it is not permissible to fill the cavity with any thermal insulants at the time of construction." From this it can be seen that partial fill or post construction filled cavities are to be expected in new build throughout Scotland. For new build in the West of Wales and England partial fill may be used together, or else blown materials following completion of construction (the latter is dependent upon the interpretation of the wording of Chapter 6.1 of the NHBC Standards). However it should be noted that NHBC guidelines only apply where NHBC certification is applicable and may not necessarily apply to RMI work, self-build and smaller builders.

Glass wool is used primarily in full fill and blown applications because its heat transfer properties require the full width of the cavity to provide an adequate level insulation. Alternative full fill materials are stone wool and expanded foam products. Partial fill design solutions favour expanded foam products on account of their enhanced insulating properties.

The market for blown applications spans the new build and retro-fit markets. Glass mineral wool is the predominant material used, with significant competition from stone mineral wool indicated in 2002 market data. The alternative to mineral wools is systems based on expanded polystyrene (EPS) beads which are available in loose or board form.

3.2.3 Flooring

Insulation in the flooring sector is reported to be dominated by alternative products to glass mineral wool. Only in the area of 'matts between joists' does glass mineral wool and to a lesser extent stone mineral wool feature in a diminutive market. Figures provided by The Market for Building Insulation report March 2004, published by Construction Markets, suggest that there has been an annual decline in the demand for mineral wool matts since 2000.

‘Batts under slab’ applications for ground floor are lead by plastic foam products on account of the mechanical properties required (rigid blocks with compressive strength far greater than that of mineral wool).

3.3 Industrial and Commercial Building Construction

The industrial and commercial building construction sector forms a significant share of the total building market for insulation. Glass mineral wool shares a near equivalent portion of the market with alternative products for portal frame roofs and walls, whereas stone mineral wools have a small share possibly based on enhanced fire or acoustic properties.

For the relatively small sector of factory insulated composites stone mineral wool is recorded as dominant presumably on account of specific properties for this application.

3.4 Specialist Applications in Construction

Glass mineral wool features strongly in the framed construction area with a small share held by stone mineral wool and alternatives. Otherwise the market is dominated largely by alternatives to mineral wools with the exception of rainscreen products and to a lesser extent external wall insulation.

3.5 Fire Protection and Sound Insulation

Fire protection and sound insulation applications form a relatively small part of the total building market for insulation.

Glass mineral wool plays a significant part in this sector due to its low cost. However, stone mineral wool generally predominates on account of its enhanced properties for fire resistance.

3.6 Industrial Applications

Industrial applications have been reviewed separately from the building construction sector and include heating, ventilation and air-conditioning (HVAC) applications and industrial processes.

Applications in the industrial sector are affected by the service temperature of the application. This is not the case in the building construction sector.

For the lower temperature application of HVAC pipework systems, glass mineral wool, stone mineral wool and alternatives compete on a roughly even basis with the highest share to glass mineral wool. For the niche sector of HVAC flexible sections, alternative foam products dominate. For HVAC vessels, stone wool appears to have an advantage over glass wool with alternatives playing a minor role.

However, for process piping and vessels, the selection of insulating materials is influenced by service temperatures. Glass wool is normally considered up to temperatures of 230/250°C. Stone wool is seen to predominate in the range 250° to 700°C and the contribution of alternatives can be accounted for by specific conditions requiring particular material selection. Stone wool has been established as the most commonly used material for general insulation duties for pipework and vessels by market surveys.

4 Factors Affecting Choice of Material

4.1 Technical

Insulating materials may be specified to meet a number of differing requirements:

- to meet the minimum insulation requirements for occupied buildings as defined in the Building Regulations
- to increase the level of comfort in occupied buildings above the minimum statutory requirement
- to save energy in domestic, commercial or industrial applications, appliances and equipment
- to maintain a fluid (liquid or gas) at a specified temperature (for example, in an industrial process plant or HVAC systems)
- to prevent surface temperatures of industrial process plant rising to unacceptable levels.

Insulation specification will normally be carried out by the designer as part of the planning and development of the application concerned.

The designer could be a civil, structural, mechanical, building services or process engineer, an architect or a private individual who will frequently not be a specialist in insulation. The professional designer could be employed by public sector bodies, private consultants or the end-users themselves.

For any particular application, specifiers will take account of some or all of the following:

- operating temperature (including any allowance for abnormal conditions, for example process plant malfunction)
- thermal conductivity (See Appendix B)
- acoustic attenuation
- fire protection
- vapour permeance
- mechanical strength:
  - ability to withstand compression, vibration, expansion and contraction
  - ability to limit or inhibit corrosion
  - maintenance of physical properties before, during and after installation
- installation configuration
- cost
- previous experience
- health and safety aspects.

Materials are usually specified in terms of the performance required and may refer to British or other standards (see Appendix C). All new domestic buildings must comply with the revised section L of the Building Regulations, as noted elsewhere in this report. In some instances the material will be specified in generic terms. In other cases the material may be specified in terms of a particular named product and qualified by the statement ‘or equal/equivalent approved’.

Specifications are frequently based on either documentation which has been used successfully in the past and/or information provided by manufacturers (even if the manufacturer concerned may not be named in the specification). Changes to specifications will be made under the influence of unusual requirements for a particular application, unsatisfactory past performance or new product information. In most cases, contractors are given some freedom of choice in searching for the best commercial deal to suit the particular requirements of any given situation.

Specification by naming a particular product appears to be rare for industrial applications although this may be more common for domestic or small commercial developments undertaken by smaller consulting engineering or architectural practices. However, in these cases there are other products competing with those manufactured from mineral wool. Again, contractors normally have some freedom to select the most cost-effective product.

On completion of the design, implementation, including the installation of any insulation, will usually pass to a contractor or in-house direct works organisation. If the installation is large or complex, a specialist subcontractor may undertake the insulation work. For smaller and less complex installations, the main contractor may purchase the materials direct from a supplier, a manufacturer or a retailer and then install them himself.

From the information provided by house builders, and the market survey of installers MM believe there is a trend toward plastic products away from mineral fibre products. This trend had been observed following the 2002 review of thermal transfer requirements in the Building Regulations and is expected to accelerate after a further revision of the Building Regulations in 2006.

Information supplied by the parties to the Commission suggested that more than 75% of glass wool produced in the UK (by weight) was used in just two applications: cavity wall insulation and loft insulation in cold roof applications. A more detailed analysis of the factors affecting the choice of material was, therefore, carried out for these two applications.

4.2 Price

Feed back from installers indicates that price is an important factor governing the market for all types of retro-fitted loft and cavity wall insulation. MM, therefore, carried out a telephone survey of six installers in each of six separate regions of the UK. While this is a small survey, we consider the number of respondents for glass wool to give a good indication of the position. For the other products the number of respondents was small, so the results should be treated with some caution (particularly for UFF in cavity wall insulation and stone wool and cellulose in loft insulation).

Installers were asked to price the retro fit installation of insulation for a three bedroom semi-detached house with good access, a total wall area of 80m^2 and clear loft area of 50m^2. The tables in Appendix E show the detailed results of this survey. A summary is set out in the following tables (note: prices include VAT at the rate of 5% as fixed in 1998).

4.2.1 Retrofit Cavity Wall Insulation

Scotland

Material	**Average cost of Cavity wall insulation**	**No. of Installers offering System**
Stone Wool	£525	1 of 4
Glass Wool	£377	4 of 4
Bonded Beads	N/A	
UF Foam	N/A	

N. Ireland

Material	Average cost of Cavity wall insulation	No. of Installers offering System
Stone Wool	£525	1 of 6
Glass Wool	£360	3 of 6
Bonded Beads	£364	5 of 6
UF Foam	N/A	

E Anglia & South-east

Material	Average cost of Cavity wall insulation	No. of Installers offering System
Stone Wool	£343	2 of 5
Glass Wool	£391	4 of 5
Bonded Beads	£450	1 of 5
UF Foam	N/A	

North

Material	Average cost of Cavity wall insulation	No. of Installers offering System
Stone Wool	£367	2 of 6
Glass Wool	£356	5 of 6
Bonded Beads	N/A	
UF Foam	N/A	

Midlands

Material	Average cost of Cavity wall insulation	No. of Installers offering System
Stone Wool	£313	2 of 6
Glass Wool	£337	4 of 6
Bonded Beads	£350	1 of 6
UF Foam	N/A	

South-west & Wales

Material	Average cost of Cavity wall insulation	No. of Installers offering System
Stone Wool	£295	2 of 6
Glass Wool	£301	4 of 6
Bonded Beads	N/A	
UF Foam	£315	1 of 6

The average prices throughout the UK for cavity wall insulation, to the property as specified above, are as follows:

Material	Average cost of Cavity wall insulation	Average cost per square metre	No. of Installers offering System
Stone Wool	£395	£4.94	11 of 33
Glass Wool	£353	£4.41	23 of 33
Bonded Beads	£388	£4.85	7 of 33
UF Foam	£315	£3.94	1 of 33

The tables suggest that stone wool and bonded beads are rather more expensive than glass wool. However, examination of the individual regions indicates that the stone wool average is inflated by high figures in Scotland and Northern Ireland. Stone wool is competitive with glass wool in England and Wales. Similarly, bonded beads are used mainly in Northern Ireland, where they are competitive with glass wool. The two prices quoted in English regions were slightly higher than glass wool. In Northern Ireland, where bonded bead insulation appears to dominate, glass wool appears marginally cheaper than bonded bead. In terms of overall prices there appear to be predictable price variations from one region to another e.g. the South East being the most expensive.

From the above figures, it would appear that UF Foam is the cheapest form of cavity wall insulation. However the sample has been distorted by the low price from the one installer out of 33 who provided information. 23 out of 33 installers offer glass wool; this material appears to be the most commonly offered retro-fit insulation system. The figures given are the results of a random survey of installers in each of the six regions the figures are indicative only

It is concluded from this survey that mineral wools are generally both the most common and the cheapest insulation material for retro-fitted.

The average cost of cavity wall insulation materials in UK regions expressed as a percentage of the total installed cost is set out in the table below:

	Scotland	N.Ireland	North England	Midland England	South-east England	South-west & Wales	Average in UK
Stone Wool	40%	33%	37%	35%	25%	33%	34%
Glass Wool	40%	40%	34%	33%	37%	40%	37%
Bonded Beads	N/A	38%	N/A	25%	55%	N/A	36%
UF Foam	N/A	N/A	N/A	N/A	N/A	35%	35%

Materials cost, as a percentage of total costs, do not appear to vary significantly by material.

4.2.2 Loft Insulation

Scotland

Material	Average cost of Loft insulation	No. of Installers offering System
Stone Wool	N/A	
Glass Wool	£257	4 of 4
Cellulose	£260	1 of 4

N. Ireland

Material	Average cost of Loft insulation	No. of Installers offering System
Stone Wool	£500	1 of 6
Glass Wool	£203	6 of 6
Cellulose	N/A	

E Anglia & South-east

Material	Average cost of Loft insulation	No. of Installers offering System
Stone Wool	£500	1 of 5
Glass Wool	£326	4 of 5
Cellulose	N/A	

North

Material	Average cost of Loft insulation	No. of Installers offering System
Stone Wool	N/A	
Glass Wool	£225	6 of 6
Cellulose	N/A	

Midlands

Material	Average cost of Loft insulation	No. of Installers offering System
Stone Wool	N/A	
Glass Wool	£239	6 of 6
Cellulose	£261	1 of 6

South-west & Wales

Material	Average cost of Loft insulation	No. of Installers offering System
Stone Wool	£300	1 of 6
Glass Wool	£216	6 of 6
Cellulose	£200	1 of 6

The average prices throughout the UK for loft insulation, to the property as specified above, are as follows:

Material	**Average cost of Loft insulation**	**Average cost of insulation per square metre**	**No. of Installers offering System**
Stone Wool	£433	£8.66	3 of 33
Glass Wool	£244	£4.88	32 of 33
Cellulose	£260	£5.20	3 of 33

As noted above, the number of respondents for stone wool and cellulose was very low, so care should be taken in drawing conclusions on the average price of these materials.

It is clear from the information received from installers as well as information received from house builders that glass wool is the preferred insulation material for loft insulation and is unlikely to be superseded by alternative materials for the foreseeable future.

The average cost of loft insulation materials in UK regions expressed as a percentage of the total installed cost is set out in the table below:

	Scotland	N.Ireland	North England	Midland England	South-east England	South-west & Wales	Average in UK
Stone Wool	N/A	50%	N/A	N/A	40%	60%	50%
Glass Wool	41%	49%	42%	26%	43%	42%	40%
Cellulose	42%	N/A	N/A	10%	55%	75%	46%

It appears from the survey that stone wool and cellulose materials costs are a rather larger proportion of installed costs than is the case for glass wool.

4.3 Regional Differences in Material Choice

Installers of insulation materials throughout the UK regions were questioned by telephone regarding customer choice of insulation material. Apart from the anomaly in Northern Ireland, discussed below, no regional trend regarding choice of materials was apparent. The MM survey of cavity wall insulation indicates that stone wool is more expensive in Scotland and Northern Ireland than in England, These differences can be explained in part by the greater width of cavity due to Scottish Building Regulations and reduced demand for mineral wool in Northern Ireland. Of the English areas, the South-east is the most expensive of the four areas reviewed.

Plastic insulation products have made considerable inroads into the market in Northern Ireland with two of the house builders responding to the Commission survey confirming the use of plastic beads as a post completion cavity fill and the third using EPS partial fill boards, in accordance with NHBC requirements in new house building work. Plastic beaded fill has also managed to secure a substantial sector of the retrofit market. Feedback from insulation installers in Northern Ireland land indicates that this apparent anomaly appears to be attributable to the low cost being offered and a concerted marketing effort by the EPS bead providers rather than any other reason. Installers in Northern Ireland indicate the EPS bead market share as 80% of new build and 40% of retro-fit.

From the evidence of the MM telephone survey and the Construction Markets data reviewed in section 3.0, mineral wool is the predominant insulation material used throughout the UK mainland and choice appears to be based on cost.

The NHBC Standard, Chapter 6.1, provides builders and developers with clear guidelines relating to insulation requirements, regardless of material type, for walls exposed to wind driven rain. All of Scotland, Northern Ireland and generally the west of both Wales and England require different insulation measures to the rest of the UK, although this does not have a significant effect on the choice of insulating material.

4.4 New Build Cavity Wall Insulation

MM did not undertake a detailed examination of the new build sector, as the Commission conducted its own survey. The results of that survey indicated the following:

1. **Widespread use of partial fill**

From the CC survey it was apparent that house builders were making wide spread use of partial fill insulation systems. Plastic boards were the material of choice for partial fill. The use of partial fill can be partly attributed to the avoidance of full fill in areas of severe exposure to driven rain as described above.

2. **Blown wool cheapest where it can be used for cavity wall**

From the feedback from builders in the CC survey it was apparent that blown mineral wool is the cheapest option for cavity wall insulation. Stone mineral wool was the most commonly used as post construction insulation material. This appears to contradict the MM survey finding for retrofit cavity wall insulation, where glass wool was found to be the most common. The reason for this apparent contradiction may be attributed to the fact that the MM survey covered a wide range of installation contractors, and was not specifically targeted at the larger installers. Larger installers, involved with new build on a contract basis have different cost structures from smaller ones and access to better funding. They may, therefore, take a different view when choosing between the two products.

3. **Glass wool overwhelmingly used for cold lofts but warm roof growing.**

From the CC survey of house builders it was apparent that glass wool was the overwhelming choice for loft insulation.

4. **Choice of material can affect other aspects of overall construction.**

Choice of insulation material will affect the choice of other construction materials and methods. A reduced thickness of partial or full fill will need to be compensated by using an internal skin of thermally efficient, therefore more expensive concrete blocks.

With some small adjustment, examples 5 and 6 of Part L1 of the Building Regulations 2002 Edition provide a good comparison of full fill and partial fill systems. They show the required thickness of insulation to achieve target U value of $0.35 W/m^2 K$ for a standard construction using external bricks and internal standard blocks. Given that the thermal resistance values of the brick work external leaf, the block work internal leaf and the plaster board on dabs are identical, the thickness of insulating layer for full fill mineral wool and partial fill PIR (50mm of PIR and 50mm clear) may be calculated as:

Insulation material	Approximate thickness required (mm)	Total width of cavity (mm)
Post-construction mineral wool (thermal conductivity 0.04 W/mK) [Full fill]	95	95
New build PIR batts (thermal conductivity 0.023 W/mK [Partial fill]	50	100

The greater width of cavity in the partial fill case would lead to an increase in the cost per square metre, although this cost would not be significant. However, the cost of 50 mm of PIR board together with the labour costs of installing the material would be significantly greater than the cost of retro fitted cavity fill. From the CC survey of house builders, typical costs of partial fill board would be £3.50 – 4.50/m^2 (25 - 35mm thick not 50mm thick) and typical costs of post construction mineral wool cavity wall insulation 75mm thick are £1.50 – 2.00/m^2.

In practice, cavities are not currently usually as wide as those indicated in the table. Builders have preferred to keep cavities at 75 - 85mm and use a higher thermal performance block for the internal leaf. Reducing the cavity width moves the balance further in favour of mineral wool, as the reduction in the insulation is proportionately greater for partial fill (reducing from a 100mm cavity to 75mm cavity halves the thickness of partial fill insulation, because of the requirement for a 50mm clear cavity, whereas in the same circumstances the thickness of full fill insulation is only reduced by a third.

It is concluded that partial fill is generally a more expensive method of insulation.

In order to check the costs of plastic boards, MM carried out a limited telephone survey of costs of partial fill materials, supplied by builders' merchants in the south-east of England. The results are shown in the table below. The prices are based on the provision of a minimum quantity of 100 1200 mm x 450 mm 50mm thick batts or boards of material. Large contractors may be able to negotiate substantial discounts on the prices shown.

Merchant **Material**	**Builders Merchant 1**	**Builders Merchant 2**	**Builders Merchant 3**	**Builders Merchant 4**	**Builders Merchant 5**	**Builders Merchant 6**	**Average Price**
Stone wool	£1.66/m^2	£2.68/m^2				£2.63/m^2	£2.32/m^2
Glass wool		£2.75/m^2	£2.50/m^2	£1.70/m^2	£2.09/m^2		£2.26/m^2
PIR					£8.33/m^2	£9.26/m^2	£8.80/m^2
PUR	£7.11/m^2						£7.11/m^2
Polystyrene		£2.64	£3.13/m^2			£2.66/m^2	£2.81/m^2

PIR/PUR costs about four times as much as mineral wool, for thermal insulation performance about twice as good, and so is about twice the cost on a "like for like" basis. This is consistent with the information from the CC's house builders' survey. Glass wool, stone wool and EPS are similar in price and similar in thermal performance.

A total cost per square metre of installing partial/full fill batt materials has been calculated using two builder's price books. Hutchins' Small & Major Works Building Cost Black Book gives a cost of £6.85/m^2 for installing 50 mm thick glass fibre slabs in cavity walls. This cost comprises £3.32 for labour and £3.53 for materials. The material price appears consistent with the cost range of the table above, although the labour cost is significantly higher than those reported to the CC by house builders. Laxtons Building Price Book for Major & Small Works, 2004 Edition gives somewhat higher costs per square metre of wall, at £4.85 for materials and £4.61 for labour. Even accepting that the labour costs may be high, the range of cost of partial fill utilising batts, at £6.85 to £9.46/m^2, is significantly higher than the cost of £4.69/m^2 (including VAT) for blown mineral wool cavity fill in the south-east from the MM survey. The cost of using PIR/PUR plastic boards would be even higher. This is consistent with the feedback from house builders on the comparative costs of partial fill and full fill insulation materials.

5 Factors affecting the Ability of Customers to Switch between Glass Wool and Other Products

5.1 Introduction

The ability of customers to switch between glass wool and other products is dependent upon the end-use. As a sound proofing or fire resistant material, the replacements are limited to other mineral materials such as stone wool. Where glass wool is used as a thermal insulating material at ambient temperatures, then a number of other products including plastic foam insulating materials may be used.

Blown insulation products have not proved popular with house owners due to the perceived problems associated with containment of the material, possible displacement and other related problems. The blown sector is perceived to be relatively small with a near balance of glass and stone mineral wool shares by are with alternatives such as EPS beads, granular mineral products and cellulose products making a modest contribution.

The discussion below addresses the factors affecting a change between different types of mineral wool (i.e. between glass wool and stone wool) for cavity wall insulation and loft insulation. No consideration has been given to a change from mineral wool to plastic foam products where there would be a clear need to replace equipment and re-train installation crews. There does not appear to be any technical reason to prevent house builders switching from mineral wools to plastic foam insulating materials. It is concluded that the main reason preventing a switch is cost.

5.2 Installers of Mineral Wools - Cavity Walls

During the telephone survey of six installation contractors in six regions, conducted by MM, installers of glass wool cavity wall insulation expressed a strong preference towards glass wool as cavity wall insulation for the following reasons:

- **Cost**: glass wool appeared cheaper than stone wool; one installation contractor quoted glass wool at around half the cost of stone wool.
- **Installation**: stone wool is harder on blowing machines thus maintenance costs for the machines are higher.
- **Lack of choice**: Installers questioned in the MM survey advised that the rise in cost of glass wool would need to exceed 10% before they would consider alternative insulation materials.

The propensity of installers to switch depends on the equipment currently used. Those with machines capable of blowing glass and stone wool appeared to be more willing to change if prices rose by 10%, and two said they would switch if prices rose by 5%. Those with machines capable of blowing only glass wool were less inclined to consider changing unless price rises were greater, and some said they would not switch regardless of price increases. Of those that would switch, some would consider switching to EPS beads, rather than stone wool. In our survey, 11 of those who said they would switch said they would switch to stone wool and three to bonded beads. It was evident that switching from stone wool to glass wool was far easier than the reverse. Companies that have bought dedicated glass wool blowing machines for cavity wall insulation cannot use the machines for stone wool and would need to buy new machines at a cost of £12,000 to £16,000 per machine.

A further complication, although of less significance than the cost of replacing plant, is the cost of re-certifying installers of the new material, as drilling patterns and densities vary from one material to another. Installers were quite clear that while re-certification is a real cost of switching products it would not be prohibitive.

5.3 Installers of Mineral Wools – Lofts

Thirty two out of the thirty three installers interviewed were installing glass wool in lofts. From the information available from insulation installers, stone wool rarely used for loft insulation by professional installers. A change from glass wool to stone wool would increase costs both in terms of the purchase price of the product and the additional costs of transporting the material and installing it in the work location. This view is supported by the submissions to the CC made by customers

Commercial installers report a prejudice against stone wool on account of the bulk density (hence weight) being higher and the increased bulk of the as delivered product. This point is illustrated by the results of the MM telephone survey (See Table of Results in section 4.2). Glass mineral wool is packaged in compressed rolls which re-expand on application, facilitating easier transportation of the bulk material. Although stone mineral wools are also packaged in compressed rolls, the above factors are reported to be constraints when considering the competitive environment of large scale operations where the cost of operational logistics comes into play.

Reasons for the expressed preference for glass wool include:

- Cost, glass wool is cheaper than stone wool, as can be seen from the results of the MM telephone survey, installation contractors quoted glass wool at cost below that of stone wool
- Density, glass wool can be compressed to a greater extent than stone wool promoting cheaper transport. Stone wool is packaged in smaller quantities making it more labour intensive.
- Ease of installation, glass wool is easier for the installation crew to fix.
- Installers questioned in the MM survey advised that the rise in cost of glass wool would need to exceed 10% (one mentioned 40 to 50%) before they would consider alternative materials for loft insulation.

5.4 Wholesalers

Submissions to the CC from wholesalers' show mixed views regarding the substitution of stone wool and glass wool. An opinion was expressed that stone wool is a specialist product not generally stocked by wholesalers or builders' merchants. Generally, builders' merchants will stock glass wool. Buildbase builders' merchants advise that, in their opinion, stone wool is not a suitable substitute for glass wool and that demand for stone wool is negligible. Seco Trade Centres Ltd., a West Midlands based builders merchant comprising ten sites, advise that "the only real alternative to glass wool is stone wool which … is more expensive". Selco added, "it [stone wool] is also heavier which may render it unsuitable for some installations." Contrary to the above Wolesley (Build Centre) expressed the view that "stone wool is an excellent substitute for glass wool". Large installers of insulation systems negotiate discounted deals with insulation manufacturers of both stone wool and glass wool. Coronet advise that glass wool forms 85% of the insulation material they install but can be substituted by a number of other products. However, cost militates against the use of other material as can be substantiated by the MM telephone survey.

6 Current Capacity and Barriers to Entry

6.1 Current Capacity

It is clear from the evidence submitted to the CC that UK production facilities are currently at capacity. As a consequence, many products are on allocation and both insulation installation contractors and wholesalers are concerned about the availability of sufficient material to meet their requirements. Manufacturers have plans to increase capacity but it is unlikely that any substantial increase will be possible before the end of 2006.

6.2 Factors affecting the Ability of Suppliers to Switch between the Manufacture of Different Products

The processes involved with producing mineral wools are quite separate and distinct from those for producing foam type plastic products and no consideration is given to the interchange of these products. This section of the report will focus on two similar products: the switch from producing glass wool to producing stone wool and *vice versa*.

The basic raw materials for the production of glass are silica, soda ash and limestone. The basic glass product can be supplemented or replaced to a significant extent by recycled glass or cullet, the proportion of cullet used may vary from one manufacturer to another. The basic material for glass wool is heated to approximately 1400°C in an electric or gas fired furnace and the liquid material passed through spinners where the spun glass is treated with a resin and formed into matts, rolls or blocks of varying densities.

It is understood that the quality of materials used to produce the glass wool is critical to the manufacturing process. No information could be gained regarding the sensitivity of the production process to changes in supply of raw materials.

Stone wool is produced from a mixture of volcanic stone, blast furnace slag, supplementary chemicals and coke. The specification for the mix put into the blast furnace is strictly defined. However, as long as the specification can be met with a combination of stone and supplementary chemicals, then the stone material may be sourced from any location. It is understood that stone wool manufacturers may ship the raw materials from some distance in order to provide stone of a suitable quality.

The processes for the manufacture of stone wool and glass wool are different. The process of producing stone wool utilises blast furnace technology and is different to that of producing glass wool. The spinning technologies are substantially different from each other, are not in the public domain and remain the property of the individual manufacturers. It is expected that substantial investment would be required to obtain state-of-the-art technology to convert from glass wool to stone wool and *vice versa*.

If a change in the product manufactured were to be undertaken, then a number of issues need to be taken into account:

- Obtaining state-of-the-art spinner technology.
- Replacement of raw material supply sources.
- Replacement of raw material feed system.
- Replacement adaptation of firing system.
- Down time while modifications are carried out for the above.

6.3 Barriers to Entry

The parties have estimated the outline costs for entry into the market at around £1 million per 1,000 tonnes capacity. The parties said that it would not be worth building a plant for less than around 25,000 tonnes. It appears that these costs would be largely sunk.

MM believes that further limitations on entry into the market are likely to include:

- Obtaining planning and environmental consents may be time consuming and expensive in order to satisfy local planning requirements.
- Difficulties in setting up the distribution channels that a new manufacturer would have to establish to provide a network of outlets for his product.
- Difficulties in obtaining a suitably qualified workforce, even an existing manufacturer on the European mainland may find it problematic inducing skilled staff to move to the UK to establish a new manufacturing plant.
- Access to technology: a new entrant in the market place will need to have access to the relevant furnace, spinning and coating technology. Without ready access to this technology, entrants to the UK market will need to be existing producers outside the UK.
- Lack of reputation or brand recognition.
- Lack of scale, resulting in high losses in early years.
- Potential response of incumbents, it is unclear how existing glass wool manufacturers may respond to a new competitor in the market, a price war could result.
- Distances from raw materials and market places for finished product will have a significant impact on the profitability of the product.
- Provision of suitable power supplies, glass wool manufacture requires considerable inputs of energy to raise the raw material temperature to melting point. The energy may be provided by either gas or electricity but convenient connection points would need to be established. It is understood that around of 4,400 kWh (expressed as electricity and fuel) of energy per tonne is consumed in the course of glass wool production.
- Uncertainty of market predictions (sustainability of housing market). In their paper 'The market for Building Insulation Great Britain 2002 to 2004', the authors predict that "There will be a pronounced trend to the use of warm roofs… its use will reach a share of 21.5% by 2004".
- High cost of product approval/certification system.
- Extended pay back period for plant in relation to expected market trends, should market prices and profits reduce the pay back period may become uneconomical.

7 Glass Wool Technical and Regulatory Requirements

7.1 Thermal

Technical and regulatory requirements in respect of the thermal properties of glass wool are included in the following documents:

- The Building Regulations 2000 April 2002 revision, Part L1 – 'Conservation of fuel and power in dwellings' is the principal legislation dealing with the need to provide thermal insulation in domestic premises. In 2002, the requirement for thermal insulation in the loft of domestic houses increased to 270% of the required 1985 value. The current thickness requirement for mineral wools is around 270 mm. The Building Regulations Section L Table 1 gives a U-value requirement of 0.16 for a pitched roof with insulation laid between the ceiling joists.
- EN ISO 10211-1 (1995) Thermal bridges in building construction - Heat flows and surface temperatures - Part 1: General calculation methods (TC89).
- EN ISO 10211-2 (2001) Thermal bridges in building construction - Calculation of heat flows and surface temperatures - Part 2: Linear thermal bridges (TC89).
- EN ISO 14683 (1999) Thermal bridges in building construction - Linear thermal transmittance - Simplified methods and default values (TC89).
- EN ISO 10456 (1999) Thermal insulation - Building materials and products - Determination of declared and design thermal values (TC89).
- EN 12524 (2000) Building materials and products - Hygrothermal properties - Tabulated design values (TC89).
- EN ISO 13370 (1998) Thermal performance of buildings - Heat transfer via the ground - Calculation methods (TC89).
- EN 13187 (1998) Thermal performance of buildings - Qualitative detection of thermal irregularities in building envelopes - Infrared method (TC89).
- EN ISO 15927-1 (1999) Hygrothermal performance of buildings - Climatic data - Part 1 : Monthly means of single meteorological elements (TC89).
- The Construction Products Regulations: 1991 – Regulation 7.
- Relevant British Standards (see Appendix C).
- Health and Safety standards (see Appendix D).

7.2 Acoustic

There is no specific European legislation dealing with a requirement to provide sound insulation in buildings, although technical requirements are addressed in:

- The Building Regulations 2000, April 2002 revision, Part E – 'Resistance to the passage of sound' is the principal legislation dealing with the need to provide acoustic insulation in buildings.
- The Construction Products Regulations: 1991 – Regulation 7.

7.3 Fire prevention

There is no specific European legislation dealing with a requirement to provide sound insulation in buildings, although technical requirements are addressed in:

- BS 5588-1:1998 Fire precautions in the design, construction and use of buildings.
- The Building Regulations 2000, April 2002 revision, Part B – 'Fire safety' is the section of the regulations dealing with the need to provide fire prevention measures in buildings.
- The Construction Products Regulations: 1991 – Regulation 7.

Appendix A: Terms of Reference

The consultants will prepare a report identifying the alternatives to the use of glass wool throughout its range of applications (insulation of buildings, heating and ventilation, and process plant) and in various temperature ranges. It will be necessary to differentiate between applications where the only alternative to glass wool is stone wool and those where other insulating materials, such as organic materials, can also be used. It will also be necessary to distinguish between those applications where the requirement is solely for thermal insulation and those where other properties (acoustic insulation or fire resistance) are important.

The report will set out clearly:

1. the technical parameters which are significant in the choice of material, identifying where substitution between glass wool and stone wool, and between mineral wool and other materials, is technically possible ;
2. legislative and regulatory requirements;
3. the considerations bearing on well informed decisions on material choice; and
4. cost implications.

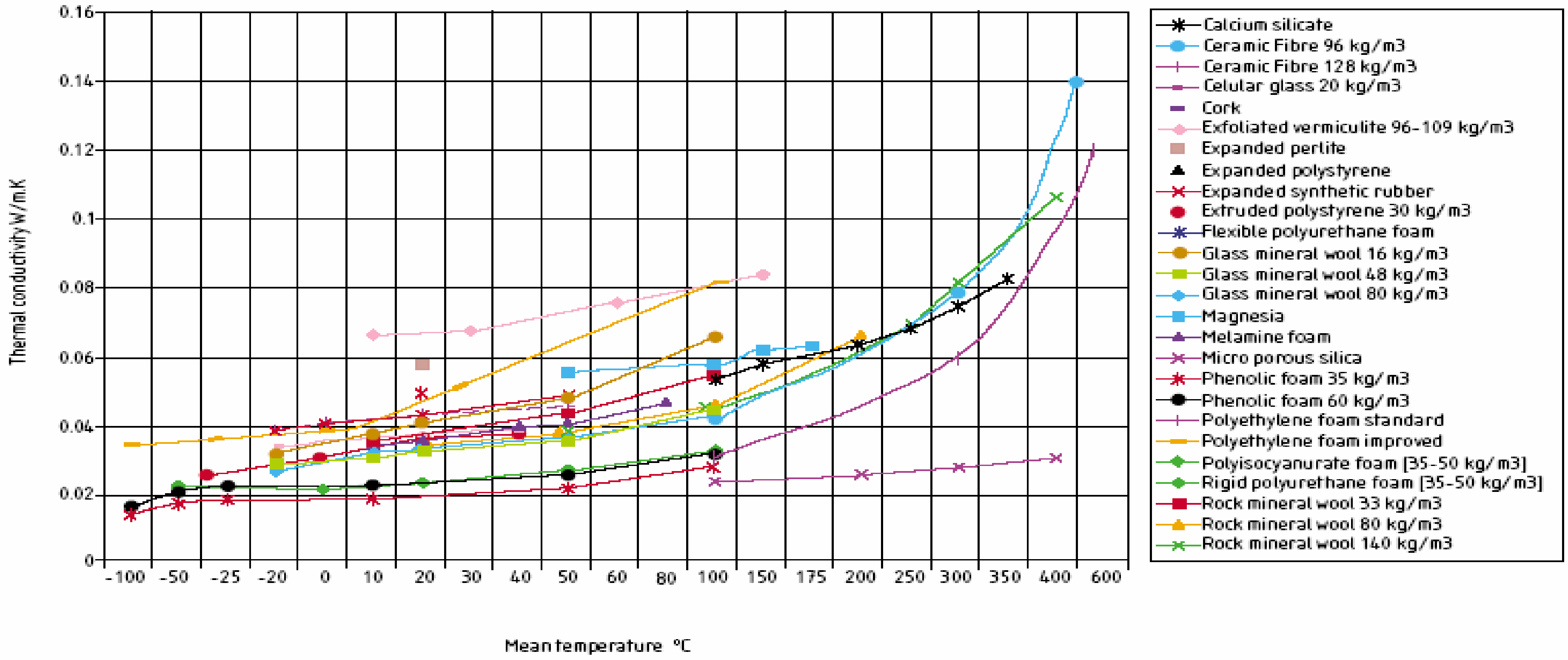
It should concentrate on applications where the technically suitable, cost-effective alternatives to mineral wool are limited or non-existent and identify the specific issues concerning the choice between glass and stone wool. Applications where there is adequate, cost-effective competition from other materials will not require detailed treatment. For areas where there is limited competition, the report should consider whether the manufacturer can differentiate these applications from others (for example, because the products are different or made in different sizes to a different specification) or not.

The report should also give some insight into how the choice between different materials is made (who by, at what stage in a project and so on) and whether different types of end-user behave differently in making this choice. It should also give insight into the extent to which custom and practice, product name and reputation, installation procedures and risk aversion are significant factors in the choice. Particular attention should be paid to areas where alternatives to glass wool are little used, despite apparent suitability.

The views of end-users, as well as installers and distributors, should be sought. Such views should be clearly distinguished from the consultants’ own judgements and attributed, in an anonymous form if necessary, to enable the identification of the sources, and the prevalence of, particular views.

The report should be prepared in a format in which it can be put to the parties and published (in whole or in part), either on the Commission’s website or as an appendix to the Commission’s report.

Appendix B: Typical Thermal Conductivity Values



NOTE 1 See 7.3.

NOTE 2 Mean temperature is the average between the inner face and the outer face temperatures.

Figure 1 — Typical thermal conductivity values for insulating materials used at above and below ambient temperatures

Source: Figure 1 of BS 5970: 2001

Appendix C: Glass wool: relevant British Standards

Terminology

BS 3533 Glossary of insulation terms

Performance standards

BS 5422 Method for specifying thermal insulating materials on pipes, ductwork and equipment (in the temperature range –40°C to 700°C).

Material specifications

BS 3958 Specifications for thermal insulating materials.

Part 3: Metal mesh faced man-made mineral fibre mattresses

Part 4: Bonded pre-formed man-made mineral fibre pipe sections

Part 5: Bonded man-made mineral fibre slabs (for use at temperatures above 50°C).

Material testing

BS 874 Methods for determining thermal insulating properties with definitions of thermal insulating terms.

BS 2972 Methods of test for thermal insulating materials.

BS 476 Fire tests on building materials and structures.

Part 4: Non-combustibility test for materials.

Part 5: Method of test for ignitability.

Part 6: Method of test for fire propagation for products.

Part 7: Surface spread of flame tests for materials.

Part 8: Test Methods and Criteria for the fire resistance of elements of building construction.

Part 11: Method of assessing the heat emission from building materials.

Part 20: Method for determination of the fire resistance of elements of construction (general principles).

Part 21: Methods for determination of the fire resistance of load-bearing elements of construction.

Part 22: Methods for determination of the fire resistance of non-load-bearing elements of construction.

Part 23: Methods for determination of the contribution of components to the fire resistance of a structure.

Part 24: Method for determination of the fire resistance of ventilation ducts.

Application methods

BS 5970 Code of Practice for thermal insulation of pipework and equipment (in the (formerly temperature range of –100°C to 870°C) CP 3005).

PD 7074-3 2 Application of fire safety engineering principles to the design of buildings – Part 3 2003 BSI.

Appendix D: References: Health and Safety

1. Safety in the use of mineral and synthetic fibres. Occupational Safety and Health Series No. 64. International Labour Office, Geneva. 1989.

2. Man-made mineral fibres. Guidance Note EH 46. Health and Safety Executive. 1990.

3. Some Occupational Hygiene Aspects of Man-Made Mineral Fibres and New Technology Fibres. Health and Safety Executive, Technology Division. Specialist Inspectors Report Number 27. 1990.

4. Report on Natural and Man-made Mineral fibres: UK research priorities. Medical Research Council. Institute for Environment and Health. 1995.

5. Man-made Mineral fibre airborne number concentration by phase-contrast light microscopy. Health and Safety Executive. Occupational Medicine and Hygiene Laboratory. 1988.

6. Environment Health Criteria 77: Man-made Mineral Fibres. World Health Organisation. Geneva. 1988.

7. Loss reduction Note No.6: Man-made Mineral Fibres. The Loss Prevention Council, Technical Centre. 1990.

8. Summary Criteria for Occupational Exposure limits. EH64. Health and Safety Executive. 1996.

9. Manufactured Mineral fibres. London Hazards Centre. 1990.

10. Good Air Quality in Your Home. Department of the Environment.

11. Surveillance of people exposed to risks at work. Principles and practices for the surveillance of people exposed to physical, chemical and biological health risks at work. Health and Safety Executive. 1990

12. EC Directive 97/69/EC. Official Journal of the European Communities 13 December 1997.

13. Health and safety fact sheet – Mineral wool insulation EUROSIL January 2003

Appendix E: Results of MM Telephone Survey

Scotland - Contractor	**Insulation Location, Type and Price**	
	Walls	**Roof**
Contractor 1 Material	Glass Wool £290.00	Glass Wool £260.00
Labour, Overheads & Profit Materials	60% 40%	58% 42%
What price rise in glass wool would cause a change in insulation material	Price increase of 5% or more would cause move to stone wool insulation delivery system	
Contractor 1 Material		Cellulose £260.00
Labour, Overheads & Profit Materials		58% 42%
Contractor 2	Glass Wool £325.00	Glass Wool £200.00
Labour, Overheads & Profit Materials	NO INFORMATION	NO INFORMATION
What price rise in glass wool would cause a change in insulation material	Would not consider stone wool and move to EPS bonded beads instead.	
Contractor 3	Glass Wool £475.00	Glass Wool £200.00
Labour, Overheads & Profit Materials	60% 40%	60% 40%
Contractor 3	Stone Wool £525.00	
Labour, Overheads & Profit Materials	60% 40%	
Contractor 4	Glass Wool £420.00	Glass Wool £370.00
Labour, Overheads & Profit Materials	NO INFORMATION	NO INFORMATION
Contractor 5	NO RESPONSE	NO RESPONSE
Labour, Overheads & Profit Materials		
Contractor 6	NO RESPONSE	NO RESPONSE
Labour, Overheads & Profit Materials		

Northern Ireland - Contractor	**Insulation Location, Type and Price**	
	Walls	**Roof**
Contractor 1 Material	Bonded Beads £400.00	Glass Wool £200.00
Labour, Overheads & Profit Materials	60% 40%	50% 50%
Contractor 2 Material	Bonded Beads £320.00	
Labour, Overheads & Profit Materials	55% 45%	
Contractor 3	Bonded Beads £300.00	Glass Wool £200.00
Labour, Overheads & Profit Materials	73% 27%	50% 50%
Contractor 3	Glass Wool £350.00	Stone Wool £500.00
Labour, Overheads & Profit Materials	67% 33%	50% 50%
Contractor 3	Stone Wool £525.00	
Labour, Overheads & Profit Materials	67% 33%	
What price rise in glass wool would cause a change in insulation material	Demand for glass and stone wool products is so low that an increase in the cost of glass wool would not affect cavity wall business.	
Contractor 4	Glass Wool £380.00	Glass Wool £150.00
Labour, Overheads & Profit Materials	60% 40%	60% 40%
Contractor 4	Bonded Beads £400.00	Glass Wool £150.00
Labour, Overheads & Profit Materials	60% 40%	60% 40%
Contractor 5	Glass Wool £350.00	Glass Wool £270.00
Labour, Overheads & Profit Materials	55% 45%	45% 55%
Contractor 6	Bonded Beads £400.00	Glass Wool £250.00
Labour, Overheads & Profit Materials	NO INFORMATION	NO INFORMATION

East Anglia & South-east England - Contractor	**Insulation Location, Type and Price**	
	Walls	**Roof**
Contractor 1	Stone Wool £336.00	Glass Wool £254.00
Labour, Overheads & Profit Materials	NO INFORMATION	NO INFORMATION
Contractor 2	Stone Wool £350	Glass Wool £210
Labour, Overheads & Profit Materials	75% 25%	70% 30%
Contractor 2	Glass Wool £350	
Labour, Overheads & Profit Materials	75% 25%	
What price rise in glass wool would cause a change in insulation material	Both stone & glass wool already provided for walls but only an increase in excess of 40 to 50% would prompt change from glass wool to stone wool for lofts	
Contractor 3	Glass Wool £400.00	Glass Wool £225.00
Labour, Overheads & Profit Materials	55% 45%	45% 55%
What price rise in glass wool would cause a change in insulation material	Could not afford to change delivery systems, capital costs for a new system area too high	
Contractor 4	Glass Wool £350.00	Stone Wool £240.00
Labour, Overheads & Profit Materials	60% 40%	60% 40%
Contractor 4	Bonded Bead £450.00	
Labour, Overheads & Profit Materials	45% 55%	
What price rise in glass wool would cause a change in insulation material	Would drop the installation of glass wool and concentrate on EPS bonded beads.	
Contractor 5	Glass Wool £474.00	Glass Wool £345.00
Labour, Overheads & Profit Materials	NO INFORMATION	NO INFORMATION
What price rise in glass wool would cause a change in insulation material	Price increase of 5% or more would cause move to stone wool insulation delivery system	
Contractor 6	NO RESPONSE	NO RESPONSE
Labour, Overheads & Profit Materials		

North England -Contractor	**Insulation Location, Type and Price**	
	Walls	**Roof**
Contractor 1	Stone Wool £350.00	Glass Wool £200.00
Labour, Overheads & Profit Materials	60% 40%	60% 40%
Contractor 1	Glass Wool £350.00	
Labour, Overheads & Profit Materials	60% 40%	
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation delivery system	
Contractor 2	Glass Wool £363.00	Glass Wool £261.00
Labour, Overheads & Profit Materials	70% 30%	70% 30%
Contractor 2	Stone Wool £363.00	
Labour, Overheads & Profit Materials	70% 30%	
What price rise in glass wool would cause a change in insulation material	Expects both glass wool and stone wool prices to increase at the same therefore sees no reason to change materials	
Contractor 3	Stone Wool £370.99	GlassWool £290.00
Labour, Overheads & Profit Materials	60% 40%	50% 50%
Contractor 4	Glass Wool £400.00	Glass Wool £300.00
Labour, Overheads & Profit Materials	NO INFORMATION	60% 40%
What price rise in glass wool would cause a change in insulation material	Would need to give further cost increases serious consideration before changing materials	
Contractor 5	Glass Wool £350.00	Glass Wool £280.00
Labour, Overheads & Profit Materials	75% 25%	65% 35%
Contractor 6	Glass Wool £320.00	Glass Wool £220.00
Labour, Overheads & Profit Materials	60% 40%	70% 30%
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation system	

Midland England - Contractor	**Insulation Location, Type and Price**	
	Walls	**Roof**
Contractor 1	Glass Wool £350.00	Glass Wool £261.00
Labour, Overheads & Profit Materials	80% 20%	90% 10%
Contractor 1	Bonded Beads £350.00	Cellulose £261.00
Labour, Overheads & Profit Materials	75% 25%	90% 10%
What price rise in glass wool would cause a change in insulation material	Would bear the cost of future increases in glass wool prices.	
Contractor 2	Stone Wool £300.00	Glass Wool £250.00
Labour, Overheads & Profit Materials	65% 35%	65% 35%
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation system	
Contractor 3	Stone Wool £325.00	Glass Wool £255.00
Labour, Overheads & Profit Materials	NO INFORMATION	NO INFORMATION
What price rise in glass wool would cause a change in insulation material	Would drop the installation of glass wool and change material to EPS bonded beads.	
Contractor 4	Glass Wool £310.00	Glass Wool £200.00
Labour, Overheads & Profit Materials	60% 40%	70% 30%
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation delivery system	
Contractor 5	Glass Wool £370.00	Glass Wool £250.00
Labour, Overheads & Profit Materials	NO INFORMATION	NO INFORMATION
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation system	
Contractor 6	Glass Wool £320.00	Glass Wool £220.00
Labour, Overheads & Profit Materials	60% 40%	70% 30%

South-west England & Wales - Contractor	**Insulation Location, Type and Price**	
	Walls	**Roof**
Contractor 1	Stone Wool £350.00	Glass Wool £280.00
Labour, Overheads & Profit Materials	75% 25%	65% 35%
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation delivery system	
Contractor 2	UF Foam £315.00	Glass Wool £250.00
Labour, Overheads & Profit Materials	65% 35%	65% 35%
Contractor 3	Glass Wool £240.00	Glass Wool £185.00
Labour, Overheads & Profit Materials	60% 40%	40% 60%
Contractor 3	Stone Wool £240.00	Stone Wool £300.00
Labour, Overheads & Profit Materials	60% 40%	40% 60%
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation	
Contractor 4	Glass Wool £305.00	Glass Wool 250.00
Labour, Overheads & Profit Materials	60% 40%	60% 40%
Contractor 4		Cellulose £200.00
Labour, Overheads & Profit Materials		25% 75%
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation delivery system	
Contractor 5	Glass Wool £360.00	Glass Wool £180.00
Labour, Overheads & Profit Materials	60% 40%	60% 40%
What price rise in glass wool would cause a change in insulation material	Price increase of 10% or more would cause move to stone wool insulation delivery system	
Contractor 6	Glass Wool £301.00	Glass Wool £152.00
Labour, Overheads & Profit Materials	NO INFORMATION	NO INFORMATION