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2 BUILDING INSULATION

2.1 GENERAL

2.1.1 Scope

1 This Part specifies the type, quality and application of exterior wall insulation.

2 Related Sections are as follows:

This Section
Part 1..... General

Section 5 Concrete
Section 13 Masonry
Section 18 Carpentry, Joinery and Ironmongery

2.1.2 References

1 The following standards are adopted and/or referred to in this Section:

ASTM C208.....Standard Specification for Cellulosic Fiber Insulating Board

ASTM C332.....Standard Specification for Lightweight Aggregates for Insulating Concrete

ASTM C549 .....Standard Specification for Perlite Loose Fill Insulation

ASTM C578.....Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation

ASTM C656.....Standard Specification for Structural Insulating Board, Calcium Silicate

ASTM C726.....Standard Specification for Mineral Wool Roof Insulation Board

ASTM C1014.....Standard Specification for Spray-Applied Mineral Fiber Thermal and Sound Absorbing Insulation

ASTM C1045 .....Standard Practice for Calculating Thermal Transmission Properties Under Steady-State Conditions

ASTM C1355/C1355M Standard Specification for Glass Fiber Reinforced Gypsum Composites

ASTM C1410.....Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation

ASTM C1481.....Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS)

ASTM C1482.....Standard Specification for Polyimide Flexible Cellular Thermal and Sound Absorbing Insulation

ASTM C1535.....Standard Practice for Application of Exterior Insulation and Finish Systems Class PI

ASTM C1693.....Standard Specification for Autoclaved Aerated Concrete (AAC)

ASTM C1694.....Standard Specification for Reinforced Autoclaved Aerated Concrete (AAC) Elements

ASTM C1696.....Standard Guide for Industrial Thermal Insulation Systems

ASTM D4637/D4637M Standard Specification for EPDM Sheet Used In Single-Ply Roof Membrane (reinforced sheets only)

ASTM D6221/D6221M Standard Specification for Reinforced Bituminous Flashing Sheets for Roofing and Waterproofing

ASTM D7465/D7465M Standard Specification for Ethylene Propylene Diene Terpolymer (EPDM) Sheet Used In Geomembrane Applications (reinforced sheets only)

ASTM E2110.....Standard Terminology for Exterior Insulation and Finish Systems (EIFS)

ASTM E2190.....Standard Specification for Insulating Glass Unit Performance and Evaluation

ASTM E2430/E2430M Standard Specification For Expanded Polystyrene (“EPS”) Thermal Insulation Boards For Use In Exterior Insulation and Finish Systems (“EIFS

ASTM E2568.....Standard Specification for PB Exterior Insulation and Finish Systems

BS 874.....Methods for determining thermal insulating properties (EN 12667 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Products of high and medium thermal resistance; EN 12664 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Dry and moist products of medium and low thermal resistance; EN 12939 Thermal performance of building materials and products - Determination of thermal resistance by means of guarded hot plate and heat flow meter methods - Thick products of high and medium thermal resistance; ISO 8990 Thermal insulation — Determination of steady-state thermal transmission properties — Calibrated and guarded hot box)

BS 1142 .....Fibre building boards (EN 622 Fibreboards.)

BS 1202 .....Specification for nails

BS 1210 .....Specification for wood screws

BS 3692 .....ISO metric precision hexagon bolts, screws and nuts. Specification

BS 3837 .....Expanded polystyrene boards (EN 13163 Thermal insulation products for buildings - Factory made expanded polystyrene (EPS) products – Specification; EN 13164 Thermal insulation products for buildings. Factory made extruded polystyrene foam (XPS) products. Specification)

BS 3958 .....Thermal insulation materials (BS 3958-1 Thermal insulating materials - Magnesia preformed insulation; BS 3958-2 Thermal insulating materials - Calcium silicate preformed insulation)

BS 4841 .....Rigid polyisocyanurate (PIR) and polyurethane (PUR) products for building end-use applications

BS 5250 .....Management of moisture in buildings. Code of practice

BS 5617 .....Specification for urea-formaldehyde (UF) foam systems suitable for thermal insulation of cavity walls with masonry or concrete inner and outer leaves

BS 5618 .....Code of practice for thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with urea-formaldehyde (UF) foam systems

BS 5803 .....Thermal insulation for use in pitched roof spaces in dwellings

BS 6203 .....Guide to fire characteristics and fire performance of expanded polystyrene materials (EPS and XPS) used in building applications

BS 6676 .....Thermal insulation of cavity walls using man-made mineral fibre batts (slabs) (EN 13162 Thermal insulation products for buildings. Factory made mineral wool (MW) products. Specification)

BS 7021 .....Code of practice for thermal insulation of roofs externally by means of sprayed rigid polyurethane (PUR) or polyisocyanurate (PIR) foam

BS 7456 .....Code of practice for stabilization and thermal insulation of cavity walls (with masonry or concrete inner and outer leaves) by filling with polyurethane (PUR) foam systems

BS 8208 .....Guide to assessment of suitability of external cavity walls for filling with thermal insulants

BS 8216 .....Code of practice for use of sprayed lightweight mineral coatings used for thermal insulation and sound absorption in buildings

BS 8233 .....Guidance on sound insulation and noise reduction for buildings

EN 771-4 .....Specification for masonry units - Part 4: Autoclaved aerated concrete masonry units

EN 998-1 .....Specification for mortar for masonry: Part 1: Rendering and plastering mortar

EN 998-2 .....Specification for mortar for masonry - Part 2: Masonry mortar

EN 3261 .....Unbacked flexible PVC flooring

EN 12602 .....Prefabricated reinforced components of autoclaved aerated concrete

EN 13162. ..... Thermal insulation products for buildings. Factory made mineral wool (MW) products. Specification

EN 13163 .....Thermal insulation products for buildings. Factory made expanded polystyrene (EPS) products. Specification

EN 13164 .....Thermal insulation products for buildings. Factory made extruded polystyrene foam (XPS) products. Specification

EN 13165 .....Thermal insulation products for buildings. Factory made rigid polyurethane foam (PU) products. Specification

EN 13166 .....Thermal insulation products for buildings. Factory made phenolic foam (PF) products. Specification

EN 13167 .....Thermal insulation products for buildings. Factory made cellular glass (CG) products. Specification

EN 13168. .....Thermal insulation products for buildings. Factory made wood wool (WW) products. Specification

EN 13169. .....Thermal insulation products for buildings. Factory made expanded perlite board (EPB) products. Specification

EN 13170. .....Thermal insulation products for buildings. Factory made products of expanded cork (ICB). Specification

EN 13171 .....Thermal insulation products for buildings. Factory made wood fibre (WF) products. Specification

EN 13172 .....Thermal insulation products. Evaluation of conformity

EN 13467 .....Thermal insulating products for building equipment and industrial installations. Determination of dimensions, squareness and linearity of preformed pipe insulation

EN 14319-1 .....Thermal insulating products for building equipment and industrial installations. In-situ formed dispensed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products

EN 14320-1 .....Thermal insulating products for building equipment and industrial installations. In-situ formed sprayed rigid polyurethane (PUR) and polyisocyanurate foam (PIR) products

EN 14496 .....Gypsum based adhesives for thermal/acoustic insulation composite panels and plasterboards. Definitions, requirements and test methods

EN 1745 .....Masonry and masonry products — Methods for determining design thermal values

EN 12467 .....Fibre-cement flat sheets - Product specification and test methods

EN 13501-1 .....Fire classification of construction products and building elements — Part 1: Classification using test data from reaction to fire tests

EN 13950 .....Gypsum plasterboard thermal/acoustic insulation composite panels - Definitions, requirements and test methods

ISO 12575-1.....Thermal insulation. Exterior insulating systems for foundations Material specification

ISO 12575-2.....Thermal insulation products. Exterior insulating systems for foundations: Principal responsibilities of installers

ISO 11925-2.....Reaction to fire tests -- Ignitability of products subjected to direct impingement of flame -- Part 2: Single-flame source test

Building Bulletin 93: ...Acoustic design of schools: performance standards

Health Technical Memorandum 08-01: Acoustics

2.2 THERMAL INSULATION

2.2.1 Minimum Envelope Performance Requirements

1 For all new air conditioned buildings, exterior building elements must have average thermal transmittance (also known as U Value) and Shading Coefficients (SC) that does not exceed the values specified and Light Transmittance greater than or equal to the values specified.

(a) External Walls, Roofs and Floors:

Building elements forming the external walls and floors (where one side of the floor is exposed to ambient conditions) must have an average thermal transmittance (U Value) which does not exceed the following values:

Roof	U= 0.44W/m^{2}K
External Wall	U=0.57W/m^{2}K
Floor	U=0.57W/m^{2}K

If the floor is in contact with the ground, the insulations should only be applied to one meter (1m) in from the perimeter of the building.

Glazed elements with back insulated panels must be treated as walls (and therefore must meet the performance requirement for walls.)

(b) Glazed Elements-Fenestration: Energy & Water Conservation Code (KAHRAMAA)

2 If the total area of external walls that let in light is forty percent (40%) or less of the external wall area, then the glazing elements must meet the following performance criteria:

Thermal Transmittance (Summer U Value)	U=2.1W/m²K (max)
Shading Coefficient (SC)	0.4 (max)
Light Transmittance	0.25 (min)

3 If the total area of external walls that let in light is between forty percent (40%) and sixty percent (60%) of the external wall area, then the glazing elements must meet the following performance criteria:

Thermal Transmittance (Summer U Value)	U=1.9W/m²k (max)
Shading Coefficient (SC)	0.32 (max)
Light Transmittance	0.1 (min)

4 If the total of external walls that let in light is sixty percent (60%) or greater of the external wall area, then the glazing elements must meet the following performance criteria.

Thermal Transmittance (Summer U Value)	U=1.9W/m²K (max)
Shading Coefficient (SC)	0.25 (max)
Light Transmittance	0.1 (min)

5 For shop fronts and showrooms, other than those at ground floor level, glazing elements must meet the following performance criteria:

Thermal Transmittance (Summer U Value)	U=1.9W/m²K (max)
Shading Coefficient (SC)	0.76 (max)

6 If the glazing portion of a roof is ten percent (10%) or less of the roof area, then the glazing elements must meet the following performance criteria:

Thermal Transmittance (Summer U Value)	U=1.9W/m²K (max)
Shading Coefficient (SC)	0.32 (max)
Light Transmittance	0.4 (min)

7 If the glazing portion of a roof is greater than ten percent (10%) of the roof area, then the glazing elements must meet the following performance criteria:

Thermal Transmittance (Summer U Value)	U=1.9W/m²K (max)
Shading Coefficient (SC)	0.25 (max)
Light Transmittance	0.3 (min)

2.3 ACOUSTICAL CONTROL

2.3.1 References

Building Type	Document Reference
Villas/Residential Buildings	Building Regulations Approved Document E (UK)
Healthcare Facilities	Health Technical Memorandum 08-01 (UK)
Educational facilities	Building Bulletin 93: Acoustic Design of Schools – A design Guide (UK)
Commercial Buildings	BS 8233 “Guidance on sound insulation and noise reduction for buildings”
Industrial	BS 8233 “Guidance on sound insulation and noise reduction for buildings”
Public	BS 8233 “Guidance on sound insulation and noise reduction for buildings”

**Residential buildings include Villas, Apartments, Worker Accommodations and Student Accommodations.*

***Educational Facilities include Nursery Schools, Primary Schools, Secondary Schools, Colleges and Universities.*

2.4 INSULATION MATERIAL TYPES

2.4.1 General

1 Various types of insulation may be specified for varying conditions or wall construction. The BS, EN classification system is to be used for insulation material; or to any other reference mentioned in paragraph 2.1.2 , or comply with any relevant standard adopted by Qatar Standards, and shall be approved by the Engineer.

2 The Contractor shall use only one type of insulation in any particular area where more than one type is optional unless approved otherwise by the Engineer.

3 At least thermal insulation is to be used for exterior roofs and exterior walls of the building

4 Where insulation is used for exterior walls, roof surfaces, or below grade, the requirements for condensation control shall be to BS 5250 and BS 5803.

2.4.2 External Thermal Insulation Composite System (ETICS)

1 If specified the external thermal insulation composite system (ETICS) shall be bonded system and tested in accordance with ETAG-004 (European organization for technical approvals):-

2 The external thermal insulation system shall compose of the following components:-

(a) Adhesive layer
(b) Extruded or expanded Polystyrene board
(c) Insulation boards fasteners (Plastic or metal)
(d) Cementitious adhesive protective mortar layer
(e) Fibremesh reinforcement
(f) Cementitious adhesive protective mortar layer
(g) Decorative layer of acrylic or polymer modified cementitious mortar

2.4.3 Cavity Wall Insulation

1 Mineral Fibre Board shall comply with the relevant provisions of BS 1142 and be faced with a vapour retarder having a perm rating of not more than 0.5.

2 Polyurethane or polyisocyanurate board shall comply with the relevant provisions of BS 4841 and be faced with a vapour retarder having a perm rating of not more than 0.5.

3 Polystyrene board shall comply with the relevant provisions of BS 3837.

4 Foam system insulation used in cavity walls shall be to BS 5617 and BS 5618.

5 Unless otherwise stated on the drawings cavity wall insulation shall be extruded polystyrene board of minimum density 25 kg/m^3 to the thickness detailed.

2.4.4 Perimeter Insulation

1 Polystyrene board where used for exterior perimeter insulation below ground and in contact with soil shall comply with the relevant provisions of BS 3837 and BS 8216.

2 Where sprayed lightweight mineral coatings are used, they shall be to BS 8216.

2.4.5 Exterior Framing or Furring Insulation

1 On approval by the Engineer, batt or blanket type insulation can be used for exterior wall insulation provided that proper protection, as designated in the Project Documentation, is present.

2 Mineral fibre shall comply with the relevant provisions of BS 6676.

2.4.6 Rigid Insulation

1 Rigid insulation shall be applied to the inside face of exterior walls, spandrel beams, floors and where indicated in the Project Documentation.

2 Mineral fibre board shall comply with the relevant provisions of BS 6676 Part 1 and Part 2.

2.4.7 Masonry Fill Insulation

1 Vermiculite insulation shall comply with the relevant provisions of BS 8208.

2 Fasteners for masonry fill insulation shall be as follows:

(a) staples or nails complying with the relevant provisions of BS 1202, zinc-coated, size and type best suited for purpose.

(b) screws complying with the relevant provisions of BS 1210 and BS 3692, with washer not less than 50 mm in diameter.

(c) steel impaling pins with heads not less than 50 mm in diameter with adhesive for anchorage to substrata; the impaling pins shall be of sufficient length to extend beyond the insulation and retail cap washer when a washer is placed on the pin.

2.4.8 Adhesive

1 Adhesives shall be as recommended by the manufacturer of the insulation.

2.4.9 Tape

1 Tape used to seal cuts, tears or unlapped joints of insulation shall have pressure sensitive adhesive on one face.

2 The perm rating of the tape shall not be more than 0.50.

2.4.10 Autoclaved Aerated Concrete (AAC) Block

1 Masonry Unites (AAC Block) shall comply with the requirement for thermal insulation according to 2.2 , and shall be complied with the requirement thermal insulation materials as specified within EN1745

2.5 INSTALLATION

2.5.1 Execution and Workmanship

1 Insulation shall be installed with the vapour barrier facing the heated side, unless specified otherwise.

2 Rigid insulating units shall be installed with joints close and flush, in regular courses and with cross-joints broken.

3 Batt or blanket insulation shall be installed with tight joints and filling framing void completely. Seal cuts, tears, and unlapped joints with tape.

4 Insulation shall be fitted tight against adjoining construction and penetrations, unless specified otherwise.

2.5.2 Masonry Cavity Walls

1 Insulation shall be mounted on exterior faces of inner leaves of masonry cavity walls and brick faced concrete walls. Fill joints with the same material used for bonding.

2 Polystyrene board shall be bonded to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of insulation manufacturer.

3 Mineral fibreboard and polyurethane shall be bonded to surfaces with adhesive as recommended by insulation manufacturer.

2.5.3 Perimeter Insulation

1 When applying vertical perimeter insulation, the contractor shall:

(a) fill joints of insulation with the same material as used for bonding

(b) bond polystyrene board to surfaces with adhesive or Portland cement mortar mixed and applied in accordance with recommendations of the insulation manufacturer.

2 When applying horizontal perimeter insulation under concrete floor slabs the Contractor shall:

(a) lay insulation boards and blocks horizontally on level, compacted and drained fill

(b) extend insulation from foundation walls towards the centre of the building.

2.5.4 Exterior Framing or Furring Blanket Insulation

1 The insulation shall be packed around door frames and windows and in building expansion joints, door soffits and other voids. Open voids are not permitted. The insulation shall be held in place with pressure sensitive tape.

2 Vapour retarder flanges shall be lapped together over the face of the framing for a continuous surface. Seal all penetrations through the insulation.

3 The blanket insulation shall be fastened between metal studs or framing and exterior wall furring by continuous pressure sensitive tape along flanged edges.

4 The blanket insulation between wood studs or framing shall be fastened with nails or staples through the flanged edges on the face of the stud. Fastenings shall be spaced the not more than 150 mm apart.

5 For roof rafter insulation or floor joist insulation, mineral fibre blankets shall be placed between the framing to provide not less than a two 50 mm space between the insulation and the roof sheathing or sub-floor.

6 Ceiling insulation and soffit insulation shall be as follows:

(a) at wood framing, blanket insulation shall be fastened between the wood framing or joist with nails or staples through flanged edges of insulation.

(b) at metal framing or ceiling suspension systems, blanket insulation shall be installed above suspended ceilings or metal framing at right angles to the main runners or framing; the insulation shall be taped tightly together so no gaps occur and metal the framing members are covered by insulation.

(c) in areas where suspended ceilings adjoin areas without suspended ceilings, either blanket, batt, or mineral fibreboard insulation shall be installed; the insulation shall extend from the suspended ceiling to underside of deck or slab above; the insulation shall be secured in place to prevent collapse or separation of the insulation and maintain it in a vertical position; blanket or batt insulation shall be secured to the structure above with continuous cleats.

2.5.5 Rigid Insulation

1 Rigid insulation shall be securely fixed to the interior face of exterior walls of solid masonry, or to concrete walls, beams, beam soffits, underside of floors, and to the face of studs where shown on the Project Drawings for interior walls unless otherwise approved by the Engineer.

2 The insulation shall be bonded to solid vertical surfaces with adhesive as recommended by insulation manufacturer. Joints shall be filled with adhesive cement.

3 Impaling pins shall be used for attachment of the insulation to the underside of horizontal surfaces. Fastenings shall be spaced as necessary to hold insulation in place and prevent sagging.

4 Insulation board is to be fastened at walls or underside of ceilings with screws, nails or staples. Fastenings shall be spaced not more than 25 mm apart and there shall be a fastening in each corner. The fasteners shall be staggered at the joints between boards.

5 Floor insulation shall be as follows:

(a) insulation shall be bond to concrete floors in attics by coating surfaces with hot asphalt applied at rate of not less than 35 kg per 10 m^2, and firmly bed the insulation.

(b) when applied in more than one layer, bed succeeding layers in hot asphalt applied at the rate to equal a total of not less than 35 kg per 10 m^2 when completed.

(c) insulation may be installed with non-flammable adhesive in accordance with the manufacturer's instructions when a separate vapour barrier is used.

2.5.6 Masonry Fill Insulation

1 Fill insulation shall be poured into cavity voids of masonry units from the tops of walls, or from a sill where windows or other openings occur.

2 The fill insulation shall be poured in lifts of not more than 6 metres.

2.5.7 Insulation Behind Marble Cladding

1 Insulation to external walls is to be 60, 70 or 80 mm thick, as shown on the Project Drawings; resin bonded glass fibre slabs shall be approximate 600 x 1250 mm size

2 The wall insulation is to be mounted on the outside face of the external concrete walls, behind the marble cladding panels. After ensuring that the surface is even and free from dirt, grease, oil, concrete nibs etc an approved primer is to be applied.

3 The insulation slabs are to be fixed with an approved adhesive in accordance with the manufacturer’s instructions. Both sides of the insulation are to be covered building paper. The external face of the insulation is to be finished mat black.

2.6 PREFABRICATED WALL INSULATION

2.6.1 General

1 This Clause addresses the use of insulation in prefabricated wall systems.

2.6.2 Quality and Requirements

1 Insulation and related vapour barriers or weather proofing are to be as shown on the Project Drawings and as specified in the manufacturer's literature, shop drawings and any other relevant supporting documentation.

2 Manufacturer's literature, shop drawings, supporting documentation and certification that necessary thermal requirements will be met shall be submitted to the Engineer for approval prior to delivery.

3 Thermal requirements will at minimum meet specifications as stated in this Part 2 of this Section for standard wall construction unless stated otherwise in the Project Documentation.

4 Curtain wall or glass clad wall systems are also to meet the thermal requirements of this Section. Refer to Section 25 for additional requirements.

END OF PART