



# **SELECTION GUIDE FOR EXPANDED POLYSTYRENE INSULATION APPLICATIONS**

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Endorsed by



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## FOREWORD

The Expanded Polystyrene Association of Southern Africa (EPSASA) under the aegis of AAAMSA promotes that part of the building industry which specializes in commercial, housing and cold room insulation.

Membership consists of raw material suppliers and converters of expanded polystyrene as well as machinery suppliers.

**This Selection Guide contains the following sections;**

<b>Section 1:EPS Cavity Wall Insulation</b>	<b>Page 3</b>
<b>Section 2:Externally Applied EPS Wall Insulation</b>	<b>Page 11</b>
<b>Section 3:EPS New Floor Insulation</b>	<b>Page 23</b>
<b>Section 4:EPS Roof Slab Insulation</b>	<b>Page 31</b>
<b>Section 5:Relevant Specifications and membership Role</b>	<b>Page 41</b>

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## SECTION 1

### EPS CAVITY WALL INSULATION

#### CONTENTS

	<b>Page</b>
1. Introduction	4
1.1 General	4
1.2 Moisture penetration	4
1.3 Manufacture	4
1.4 Delivery and storage	4
2. Technical Specification	4
2.1 Description	4
2.2 Site storage	5
3. Design Data	5
3.1 Strength and stability	5
3.2 Properties in relation to fire	5
3.3 Thermal insulation	6
3.4 Durability	7
4. Installation	7
5. Bibliography	41
6. Drawings	8 & 9



## **EPS CAVITY WALL INSULATION**

### **1. INTRODUCTION**

#### **1.1 GENERAL**

- 1.1.1 Expanded Polystyrene (EPS) insulation, when installed in accordance with this Guide, is effective in reducing the thermal transmittance (U value) of the walls of new and existing buildings.
- 1.1.2 EPS cavity wall insulation is made from standard EPS boards in thicknesses and edge profiles to suit the applications.
- 1.1.3 The installation of EPS insulation during the construction of walls must be carried out by competent contractors.
- 1.1.4 EPS boards are for use as a complete or partial fill to reduce the thermal transmittance of cavity walls with masonry inner and outer leaves.
- 1.1.5 EPSASA, through its members, provides technical support including application manuals and guidance on thermal performance.

#### **1.2 MOISTURE PENETRATION**

Assessment has shown that the systems will resist the passage of moisture.

#### **1.3 MANUFACTURE**

EPS cavity wall insulation is an expanded polystyrene rigid foam board produced by EPSASA members to conform to EPSASA specifications. The EPS boards are manufactured in various thicknesses and the edges may be profiled for shiplapping. EPS boards are manufactured in a variety of lengths.

#### **1.4 DELIVERY AND STORAGE**

EPS boards are delivered to site in protective plastic packaging and should be stored under cover. EPS boards must be stored flat and weighed down to prevent movement and subsequent damage. Solvents and materials containing volatile or organic components will have an adverse effect on the EPS boards. EPS boards must not be exposed to open flame or other heat sources and should not be stored near flammable liquids.

### **2. TECHNICAL SPECIFICATION**

#### **2.1 DESCRIPTION**

- a) The walls are constructed leading with either the inner or outer tier. If a residual cavity is specified the inner tier must then be constructed ahead of the outer tier and the insulation fixed to the cavity face of the inner tier. Fixing EPS boards in this manner enhances the thermal performance.
- b) EPS boards are fixed to the cavity face of the leading tier with wire ties which are additional to the cavity ties specified. These additional ties may be standard cavity ties or may be made from 2mm diameter L-shaped galvanized wire. They must be installed at the same height and mid-way between the specified cavity ties. The EPS boards must be held firmly in place while these additional ties are bent in position. Ties are bent up and down alternately to secure the lower and upper edges of the EPS boards.
- c) The installation procedure is as follows:
  - A section of the leading tier is built with wall ties in position, with consideration being given to the required height of the first fit of insulation. The first row of ties is placed in position.



- Excess mortar is removed from the cavity face of the leading tier and the EPS board is attached firmly with the wire ties. The edges of the EPS boards are carefully notched to accommodate the ties.
  - Construction of the leading tier continues ensuring that the exposed edges of the EPS boards below remain free of mortar.
  - After a few rows of EPS boards have been positioned the building of the second tier progresses insuring that if a residual cavity is required the cavity ties and cavity itself remain clear of mortar droppings.
  - The leading tier is continuously built, EPS boards installed and the second tier built, as described above until the full wall is completed.
- d) The thickness of the wall tiers and the cavity widths define the horizontal spacing of the cavity ties. Ties are installed at vertical spacings of 600mm and coincide with the horizontal joints of the EPS boards. Where window and door openings are provided, and at control joints the vertical spacing of the cavity ties must be reduced to 300mm. EPS boards must be cut to accommodate these ties. During installation of the EPS boards care must be taken not to loosen the cavity ties embedded in mortar joints.
- e) The use of cavity boards and battens helps to keep cavities and the exposed top edges of the EPS boards free of mortar droppings.
- f) EPS boards may be cut using a sharp knife or a fine tooth saw to fit round window or door openings. No gaps must be left in the insulation. Cut pieces of EPS boards must be glued in position to completely fill open spaces.

## **2.2 SITE STORAGE**

- 2.2.1 The insulation is delivered to site wrapped in polyethylene. Each pack carries the product identification and batch numbers.
- 2.2.2 The EPS boards should be stored on a firm, clean, level base, off the ground and under cover until required for use. Care must be taken when handling the insulation to avoid damage.
- 2.2.3 The EPS boards must be protected from prolonged exposure to sunlight, either by storing opened packs under cover or recovering with opaque polyethylene sheeting. Care must be taken to avoid contact with solvents or materials containing volatile organic components such as coal tar, pitch, timber newly treated with creosote, etc. The EPS boards must not be exposed to open flame or other ignition sources.

## **3. DESIGN DATA**

### **3.1. STRENGTH AND STABILITY**

- 3.1.1. EPS boards are not to be considered as contributing to the structural strength of the walls. The width of the EPS boards and any additional gaps are considered as the cavity for structural purposes.
- 3.1.2. Cavity walls must comply with the rules of the National Building Regulations or be designed in accordance with SANS 10164-1 by a competent person.
- 3.1.3. Adequate wall tie densities must be achieved in both vertical and horizontal planes.

### **3.2. PROPERTIES IN RELATION TO FIRE**

- 3.2.1. In the opinion of EPSASA it is highly unlikely that the EPS board will ignite in the cavity. The use of the EPS boards will not introduce any additional hazard in respect of behaviour in fire when compared with traditional walls.
- 3.2.2. However, in terms of SANS 10177-5, EPS boards on their own are considered combustible.

3.2.3. Cavities are to be bricked closed horizontally and/or vertically around the perimeters of defined fire rated compartments, and around any openings e.g. windows, doors, to prevent movement of toxic fumes or hot gases.

3.2.4. EPS boards must not be stored near flammable liquids, waste etc and not exposed to heat or open flames.

### 3.3. THERMAL INSULATION

3.3.1. For the purpose of U value calculations to determine if the requirements of building regulations or other regulations are met, the thermal conductivity (k value) of the insulation may be taken as  $0.037 \text{ Wm}^{-1}\text{K}^{-1}$ . This value allows for an increase in thermal conductivity due to ageing and water absorption.

3.3.2. Building regulations in South Africa are in the process of revision to include thermal performance.

3.3.3. Guidance is given in Tables 1 and 2 on selecting the thickness of insulation required to enable a wall to achieve the desired U value.

**Table 1:** U values for cavity walls finished externally in plaster and incorporating different thicknesses of insulation.

Construction	U value of construction ( $\text{Wm}^{-2}\text{K}^{-1}$ ) with EPS		
	30mm	40mm	50mm
110mm wide stock brick external leaf with plaster finish and with cavity insulation, and 110mm wide stock brick internal leaf	0,69	0,56	0,48
110mm wide concrete brick external leaf with plaster finish and cavity insulation, and 110mm wide stock brick internal leaf	0,63	0,52	0,45
110mm wide concrete brick external leaf finished with plaster and with cavity insulation, and 110mm wide concrete brick internal leaf	0,58	0,49	0,42

Note: A thermal conductivity value of  $0,037 \text{ Wm}^{-1}\text{K}^{-1}$  has been assumed for EPS, allowing for an increase in conductivity due to ageing and water absorption.

**Table 2:** U values for fair-faced cavity walls incorporating a 50 mm residual cavity and different thicknesses of insulation.

Construction	U value of construction ( $\text{Wm}^{-2}\text{K}^{-1}$ ) with EPS		
	30mm	40mm	50mm
110mm wide face brick external leaf with 50mm residual cavity and insulation, and 110mm wide stock brick internal leaf	0,62	0,52	0,44
110mm wide concrete brick external leaf with 50mm residual cavity and insulation, and 110mm wide stock brick internal leaf	0,57	0,48	0,42
110mm wide concrete brick external leaf with 50mm residual cavity and insulation, and 110mm wide concrete brick internal leaf	0,53	0,45	0,39

Note: A thermal conductivity value of  $0,037 \text{ Wm}^{-1}\text{K}^{-1}$  has been assumed for EPS, allowing for an increase in conductivity due to ageing and water absorption.

- 3.3.4 Where the insulation has not been continued into window or door reveals due to a lack of clearance, there will be a risk of cold bridging at these points. Where door and window frames are to be replaced, it is recommended that their size be adjusted to permit the reveals to be insulated.
- 3.3.5 Depending on constructional details, cold bridging can also occur at the eaves and at ground-floor level, and care should be taken to minimize this, e.g. roof or loft insulation should continue over the wall head, ensuring that ventilation openings are not obstructed.

**3.4 DURABILITY**

- 3.4.1 EPS boards for cavity walls are effective as insulation for the life of the building.
- 3.4.2 EPS boards are rot-proof, offer no food value and will remain durable and stable.
- 3.4.3 EPS boards must be stored in terms of 2.2

**4. INSTALLATION**

- 4.1 Brick or block gauges must be set so that cavity ties coincide with the width of the EPS boards at the horizontal joints of the wall insulation.
- 4.2 The embedded depth of the cavity ties must be at least 50mm in the mortar joints of each leaf. Crimped wire ties and single wire type Z-ties with central dished drips cannot be used. Cavity ties must meet the requirements of SANS 28:1986. Suitable wall tie types for cavity widths less than 75mm are:
  - \* Vertical Twist
  - \* Modified PWD
  - \* Butterfly
  - \* Double Triangle

For cavities greater than 75mm in width, only vertical twist ties (with a stiffness equal to hoop iron – mild steel 20mm wide and 4mm thick) must be used.

- 4.3 The wall ties spacing for various cavity widths must be:

Horizontal spacing of ties with vertical spacing of 600mm to comply with the tie density as required in table 7 of SANS 10164 (nominal thickness of each leaf 90mm or more).

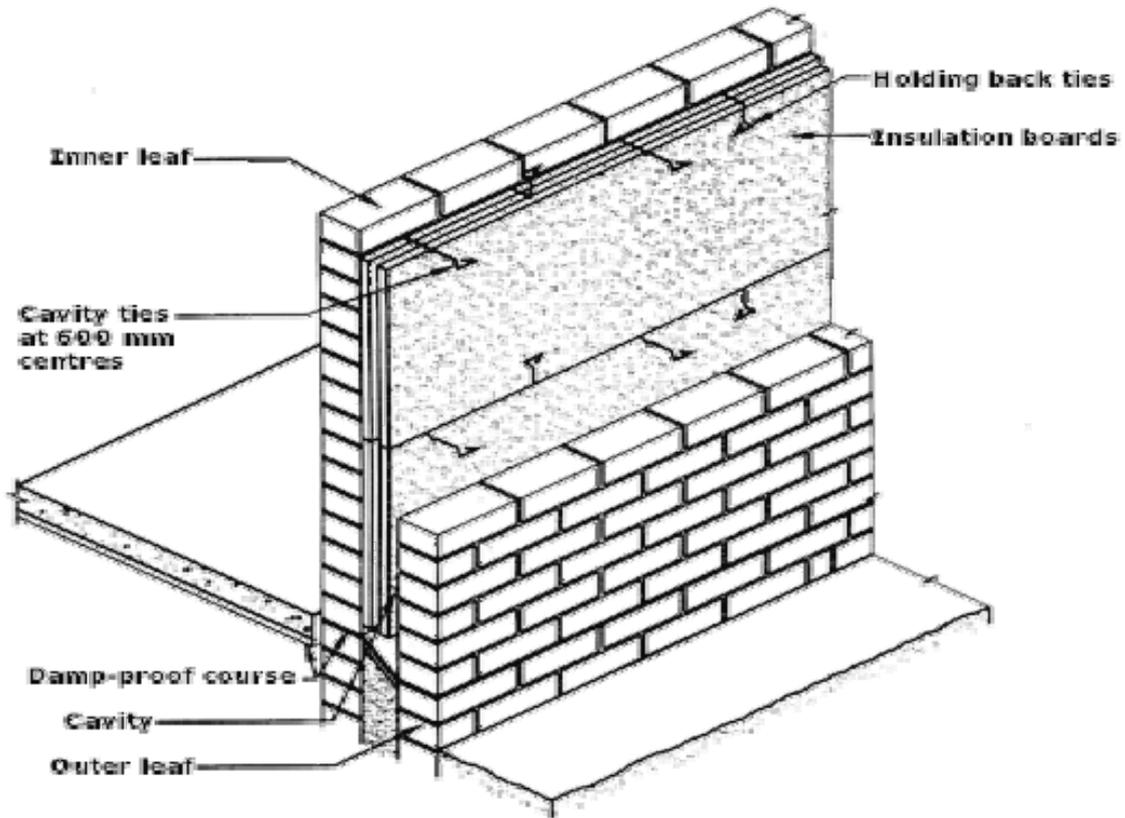
Horizontal Spacing	Cavity Width
660mm	50 – 75mm
550mm	75 – 100mm
330mm	100 – 150mm

Additional ties are required at vertical spacings not more than 300mm, near the edges of openings and at discontinuities in masonry, e.g. doors, windows, and control joints.

- 4.4 If EPS boards with shiplap joints are used, the shiplap joints must be arranged to disperse water from the inner leaf (see fig 2).
- 4.5 Debris and mortar must be removed from the cavity and exposed edges of installed EPS boards as work progresses.
- 4.6 EPS boards must be interlocked tightly with no gaps at the top and bottom of the wall, at the corners and around windows and other openings.

**5. BIBLIOGRAPHY**

Applicable SANS Codes are detailed in Section 5.



(a) First run of boards

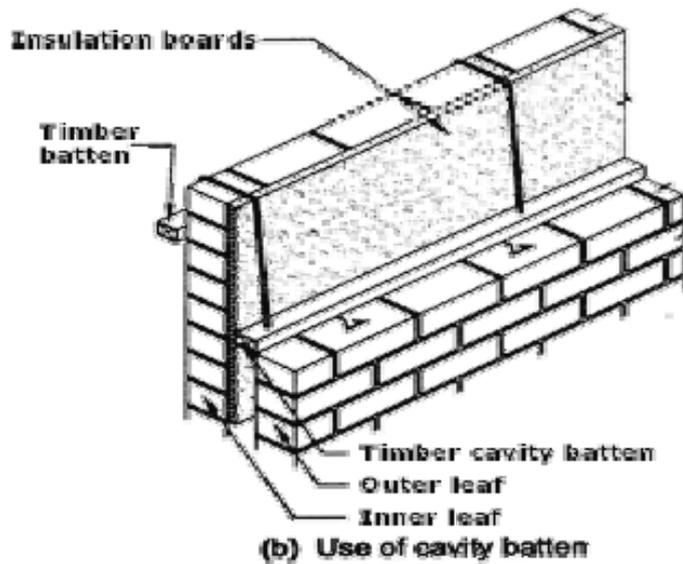


Figure 1

Typical installation details

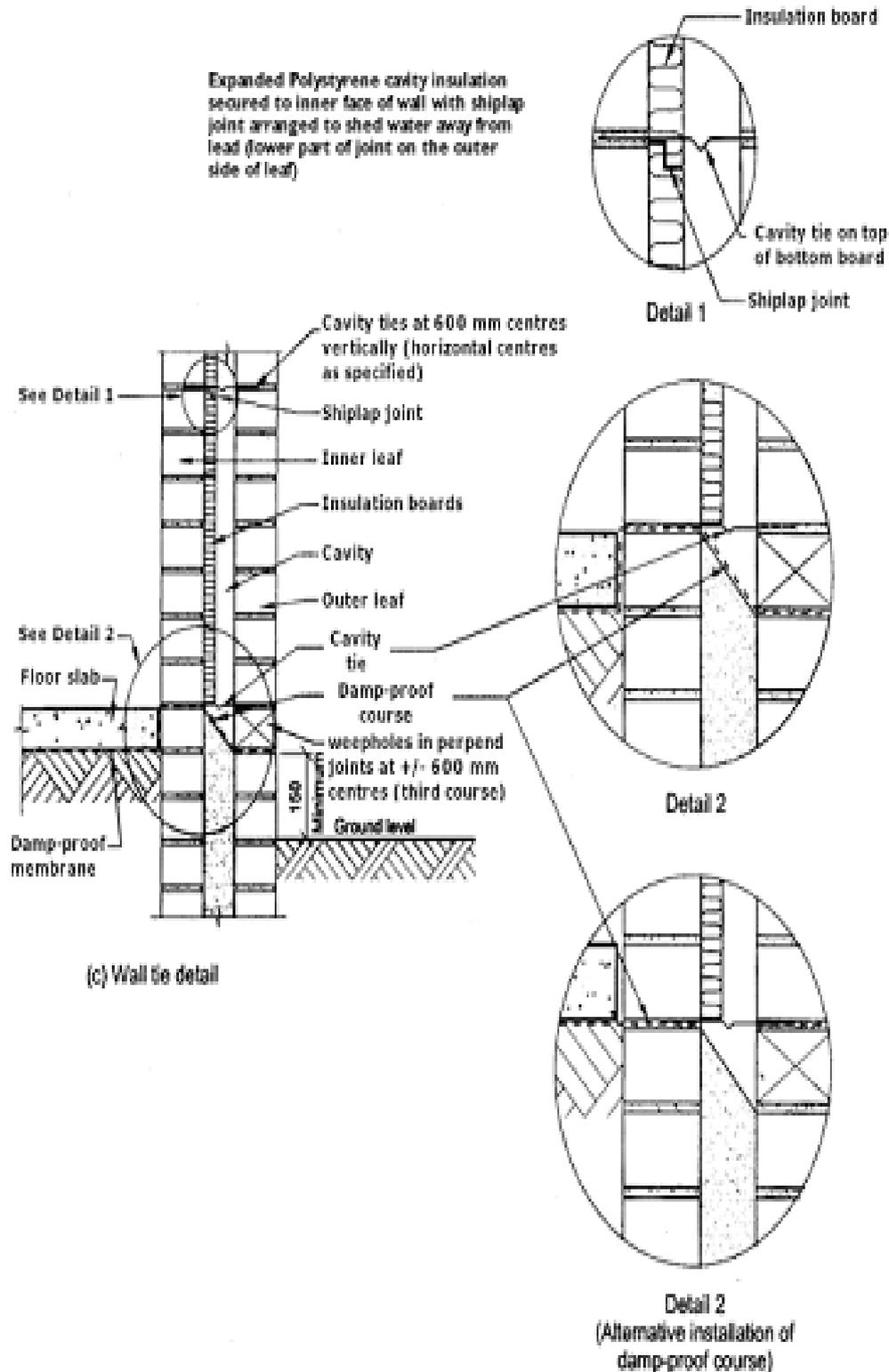


Figure 2

Typical details showing Expanded Polystyrene Cavity Wall Insulation



**NOTES**



## SECTION 2

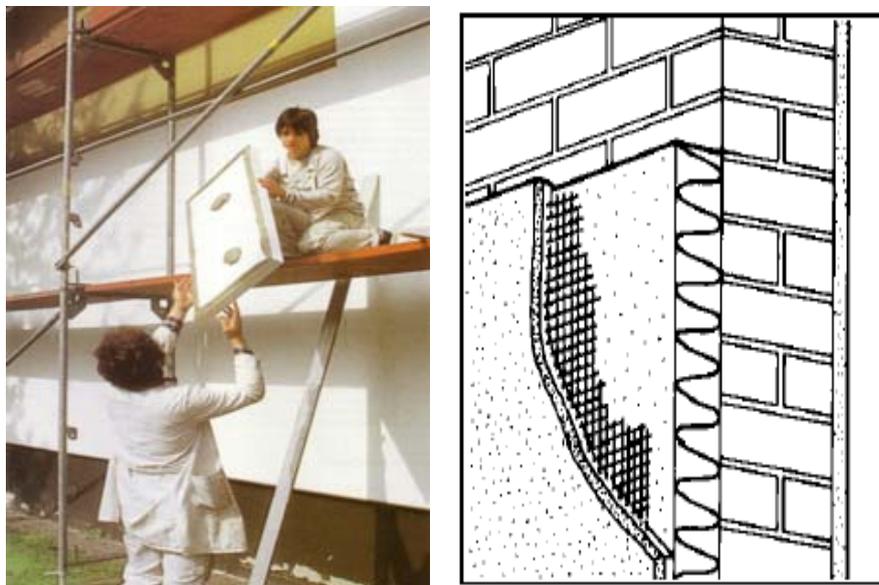
### EXTERNALLY APPLIED EPS WALL INSULATION

#### CONTENTS

	<b>Page</b>
1. Introduction	12
1.1 General	12
1.2 Risk of interstitial condensation	12
1.3 Maintenance	12
1.4 Site survey and preliminary work	13
1.5 Approved installers	13
1.6 Conditions	14
EPSASA outsulation system (External wall insulation system)	14
2. Technical Specification	14
2.1 Description	14
2.2 Delivery and site storage	15
3. Design Data	16
3.1 Strength and stability	16
3.2 Properties in relation to fire	16
3.3 Proximity of Flues	16
3.4 Thermal Insulation	16
3.5 Durability	17
3.6 Moisture penetration	17
4. Installation procedure	17
4.1 General	17
4.2 Preparation of adhesive/base coat	17
4.3 Positioning and securing insulation boards and mesh	17
4.4 Movement joints	19
4.5 Finishing	20
5. System summary	20
6. Thermal Properties	21
7. Impact Resistance	21
8. Design Wind	21
9. Bibliography	41

## EXTERNALLY APPLIED EPS WALL INSULATION

### 1. INTRODUCTION



#### 1.1 GENERAL

1.1.1 EPSASA External Wall Insulation Systems, when installed in accordance with this Guide, are effective in reducing the thermal transmittance (U value) of the walls of new and existing buildings. It is essential that the detailing techniques specified in this Guide are carried out to a high standard if the ingress of water into the insulation is to be avoided, and the full thermal benefit obtained from treatment with the systems.

1.1.2 The weather resistance of the wall will be improved by the system. External walls may, however, be installed only where other routes for moisture penetration have been dealt with separately. The systems can be used to overcome condensation associated with the internal wall surface.

1.1.3 Existing buildings should have wall surfaces in accordance with the building regulations.

#### 1.2 RISK OF INTERSTITIAL CONDENSATION

1.2.1 The relevant components of the systems have a water vapour resistance such that, under the conditions likely to be found in dwellings in most areas of South Africa, interstitial condensation should not occur within the insulation.

1.2.2 In conditions of continuous high humidity, additional measures may need to be taken to avoid possible problems from the formation of interstitial condensation in the wall.

#### 1.3 MAINTENANCE

1.3.1 Regular checks should be made on the installed system, particularly at joints, to eliminate the ingress of water. Repairs should be effected immediately by approved applicators of the system.

1.3.2 Damaged areas should be repaired using the appropriate components and procedures detailed in the Guide.



## **1.4 SITE SURVEY AND PRELIMINARY WORK**

1.4.1 A pre-installation survey of the property is carried out to determine suitability for treatment and any repairs necessary to the building structure before application of a system. A specification is prepared for each elevation of the building indicating:

- the position of beads
- additional corner mesh and reinforcement
- detailing around windows, doors and at eaves
- dpc level
- exact position of expansion joints
- areas where flexible sealants are to be used
- any alterations to external plumbing
- where required, the position of fire barriers.

1.4.2 The survey should include tests conducted on the walls of the building to determine the adequacy of the adhesive to withstand the expected wind loading derived from calculations using the relevant wind speed data for the site, and a factor of safety of 9.

1.4.3 Where it is necessary a recommendation is made on the type and number of fixings required, complementing the adhesive, to withstand the building's expected wind loading. Trial tests are conducted on the walls of the building by the approved suppliers to determine the pullout resistance of the proposed mechanical fixings. The number of fixings to be used is calculated using this data, the relevant wind speed data for the site and, in the absence of a formal requirement, a safety factor of 3.

1.4.4 All necessary repairs to the building structure are completed before installation of the system is started.

1.4.5 The flatness of surfaces must be checked; this may be achieved using a straight edge spanning the storey height. Any excessive irregularities, i.e. greater than 10mm, are to be made good prior to installation to ensure that the insulation is installed with a smooth, in-plane finished surface. Surfaces should be solid, clean and free of loose material.

1.4.6 If surfaces are covered with an existing rendering, it is essential that the bond between the background and the render is adequate. All loose areas should be hacked off and reinstated.

1.4.7 If a system is to be adhesively bonded, any painted substrates should be stripped prior to application.

1.4.8 New buildings should incorporate suitably deep sills. Existing buildings should be fitted with purpose made sills to extend beyond the finished face of the system.

1.4.9 It is recommended that external plumbing be removed, and alterations made to underground drainage, where appropriate, to accommodate repositioning on the finished face of the system.

1.4.10 New buildings should be of sound masonry or concrete construction.

1.4.11 Internal wet work, e.g. screeding or plastering, should be completed and allowed to dry prior to the application of a system.

## **1.5 APPROVED INSTALLERS**

1.5.1 Application of the systems, must be carried out by approved installers, an approved installer being a firm which:

- (1) is employing operatives who have been trained and approved to install the systems, and who have been issued with appropriate training certification.



- (2) has undertaken to comply with the application procedure, which contains the requirement for each application team to include at least one certified member.
- (3) is monitored regularly which may include unannounced site inspections.

## 1.6 CONDITIONS

### 1.6.1 This Guide:

- (a) relates only to the product that is described, installed, used and maintained as set out in the Guide;
- (c) has to be read, considered and used as a whole document – it may be misleading and will be incomplete to be selective.

## EPSASA OUTSULATION SYSTEM (EXTERNAL WALL INSULATION SYSTEM)

## 2. TECHNICAL SPECIFICATION

### 2.1 DESCRIPTION

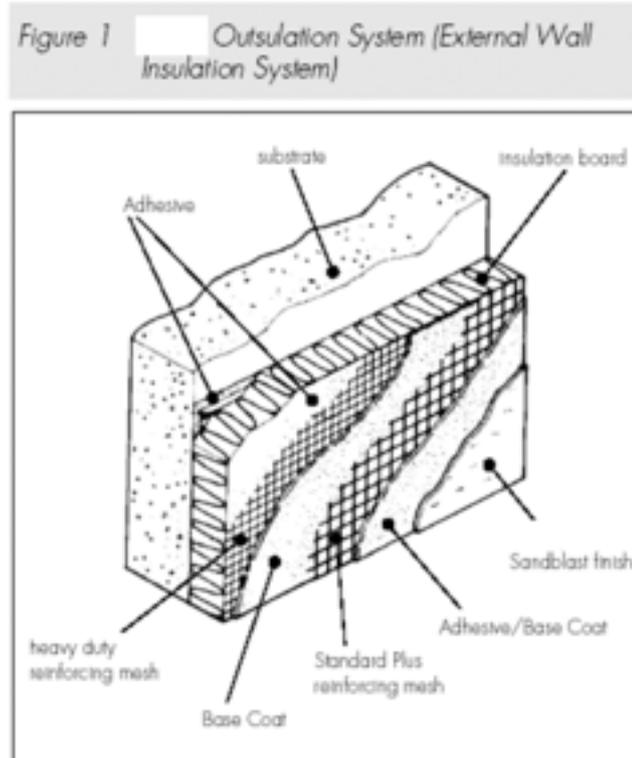
2.1.1 The EPSASA Outsulation System (External Wall Insulation System) (see Figure 1) comprises:

- (1) EPSASA approved expanded polystyrene insulation boards; 1220mm by 610mm in a range of thicknesses from 20mm through to 100mm, with a nominal density of  $15 \text{ kgm}^{-3}$  and a minimum compressive strength of  $70 \text{ kNm}^{-2}$ . Boards are manufactured to comply with the requirements for Grade SD (standard duty), type FR (flame retardant additive) material to SANS 1508 1990: Expanded polystyrene thermal insulation boards.
- (2) Adhesive/Base Coat – latex emulsion containing aggregate, coalescing and thickening agents. It is mixed on site with Portland cement in the ratio of 1:1 by weight to be used as an adhesive and/or a base coat.
- (3) Reinforcing mesh – a woven, polymer coated, glass-fibre mesh of nominal weight  $210 \text{ gm}^{-2}$  and width 1 m.
- (4) Heavy duty reinforcing mesh – a woven, polymer coated, glass-fibre mesh of nominal weight  $690 \text{ gm}^{-2}$  and width 1m.
- (5) A Woven, polymer coated, glass fibre mesh of nominal weight  $320 \text{ gm}^{-2}$  supplied in sections to be fitted at corners.
- (6) Sandblast Finishes – acrylic based emulsions containing aggregate, coalescing and thickening agents.
- (7) Ancillary materials – profiles for wall base, sills, corner beads, expansion joints, mechanical fixings, fibre barriers, etc are produced to the specifier's requirements.
- (8) Sealants – two-component polyurethane sealants in accordance with SANS 11600 (SABS ISO 11600) 1993 : Building construction : Sealants : Classification and requirements.

2.1.2 The EPS boards are fixed to the external surface of the wall using the adhesive. All insulation board edges at openings, penetrations, or other termination points, are wrapped using the mesh and fixed using the adhesive. After at least 24 hours, allowing the adhesive to fully dry, the base coat is applied to the surface of the insulation board, to a uniform thickness.

The reinforcing mesh is immediately embedded with its concave surface to the wall to reduce its tendency to curl. The surface is then smoothed with a trowel, working from the center toward the edges, until the bare mesh is fully covered and not visible. The reinforcing mesh is also wrapped around the wall corners over the corner mesh, and fixed in position by coating the faces and edges with the adhesive/base coat. Ensuring the base coat has dried, which should take a minimum of 24 hours, the finish is applied to a thickness of 1-2mm. The overall render thickness achieved should be 3-5mm.

Figure 1 : Outsulation System (External Wall Insulation System)



2.1.3 All components are subject to routine quality control.

## 2.2 DELIVERY AND SITE STORAGE

2.1.1 The EPS boards are delivered to site wrapped in polyethylene. Each pack carries the product identification and batch numbers.

2.1.2 Adhesive/base coat, finish coats reinforcing meshes are delivered to site in containers and rolls. Each container/roll carries the product identification and manufacturer's batch number.

2.1.3 The EPS boards should be stored on a firm, clean, level base, off the ground and under cover until required for use. To avoid damage the EPS boards must be handled carefully.

2.1.4 The EPS boards must be protected from prolonged exposure to sunlight, either by storing opened packs under cover or recovering with opaque polyethylene sheeting. Care must be taken to avoid contact with solvents or materials containing volatile organic components such as coal tar, pitch, timber newly treated with creosote, etc. and exposure to open flame or other ignition sources.

2.1.5 The adhesive/base coat and finish coats should be stored in a safe area, under cover, and protected from excessive heat and frost at all times. The minimum temperature for storage should be + 5°C. Open drums should be used as soon as possible.



### **3. DESIGN DATA**

#### **3.1 STRENGTH AND STABILITY**

- 3.1.1 The external wall insulation system has adequate resistance to impact and abrasion where walls are exposed. Where the system may be exposed to severe mechanical or malicious impact, e.g. walls of public buildings at ground-floor level, appropriate design measures such as supplementary reinforcement should be considered to reduce the risk of damage.
- 3.1.2 The system must be designed to withstand the thermal stresses and wind pressures (including suction) normally experienced in South Africa in accordance with SANS 10160 1989 : The general procedures and loadings to be adopted in the design of buildings.

#### **3.2 PROPERTIES IN RELATION TO FIRE**

- 3.2.1 In the opinion of the British Board of Agrément, the use of the system will not introduce any additional hazard in respect of behaviour in fire when compared with a system using traditional sand/cement render finishes.
- 3.2.2 The behaviour in fire of external wall insulation systems is the subject of recommendations by the Building Research Establishment (UK) which, for this system, makes no restriction on the height of building to be treated provided that:
- (a) fire barriers, e.g. mineral fibre 100mm high and of the same thickness as the EPS boards, are included at every floor level from the third storey.
  - (b) the reinforcing mesh and surface coating mortar is returned to the masonry at each fire barrier and fixed to restrict possible detachment.

#### **3.3 PROXIMITY OF FLUES**

When the system is installed in close proximity to certain flue pipes the relevant provisions of the building regulations or any other appropriate regulations should be met.

#### **3.4 THERMAL INSULATION**

- 3.4.1 For the purpose of U value calculations to determine if the requirements of the building regulations or other regulations are met, the thermal conductivity (k value) of the insulation may be taken as  $0.037 \text{ Wm}^{-1}\text{K}^{-1}$ .
- 3.4.2 Building regulations in South Africa are in the process of revision to include thermal performance.
- 3.4.3 Guidance on selecting the thickness of insulation required to enable a wall to achieve the desired U value can be obtained from the EPS board suppliers. Alternative approaches are also available which allow for some flexibility in design of U values for individual constructional elements.
- 3.4.4 Where the insulation has not been continued into window or door reveals due to a lack of clearance, there will be a risk of cold bridging at these points. If door and window frames are to be replaced, it is recommended that their size be adjusted to permit the reveals to be insulated.
- 3.4.5 Depending on constructional details, cold bridging can also occur at the eaves and at ground-floor level, and care should be taken to minimize this, e.g. roof or loft insulation should continue over the wall head, ensuring that ventilation openings are not obstructed.

### **3.5 DURABILITY**

- 3.5.1 The results of accelerated ageing tests indicate that the system is durable. The system should remain effective for at least 30 years, provided any damage to the surface finish is repaired immediately, and regular maintenance is undertaken including checks on joints in the system, and on external plumbing.
- 3.5.2 The finishes may become soiled in time, the rate depending on the locality. The appearance may be restored by a suitable powerwash or, if required, by the application of a compatible paint; however, great care should be taken not to adversely affect the water vapour transmission or fire characteristics of the systems.

### **3.6 MOISTURE PENETRATION**

Assessment has shown that the system will resist the passage of moisture.

## **4. INSTALLATION PROCEDURE**

### **4.1 GENERAL**

- 4.1.1 Application is carried out in accordance with the current installation instructions of this EPSASA Guide.
- 4.1.2 Application of coating materials must not be carried out at temperatures below 5°C or above 30°C, nor if exposure to frost is likely, and the coating must be protected from rapid drying. Weather conditions should therefore be monitored to ensure correct curing conditions.
- 4.1.3 All rendering should be in accordance with the relevant recommendations of BS 5262 : 1991 and BS 8000 : Part 10 : 1995.

### **4.2 PREPARATION OF ADHESIVE/BASE COAT**

- 4.2.1 The adhesive and base coat are the same material and are prepared identically. Prior to use the adhesive/base coat should be thoroughly mixed to a smooth paste. It is then mixed with Portland cement in a ratio of 1:1 (by mass) by adding small quantities and mixing thoroughly each time. Care should be taken not to overmix.

### **4.3 POSITIONING AND SECURING INSULATION BOARDS AND MESH**

- 4.3.1 Installation of the EPS boards begins at the base of the wall above the dpc. A firm, horizontal support, e.g. timber battens, which can be removed after installation, is used to mount the first row.
- 4.3.2 A strip of reinforcing mesh is cut to size and bedded along half its width to the wall, using the adhesive.
- 4.3.3 The EPS boards are coated with dabs and/or strips of adhesive and pressed firmly against the substrate. Figures 2 shows the dimensions required to achieve the correct area of coating for each EPS board. The lower edges of the first row are buttered so that the mesh can be wrapped around. After positioning the boards on the support, a ribbon of adhesive is applied to the lower faces to receive the mesh wrap (see Figure 3).

Figure 2 Insulation board dab adhesive pattern

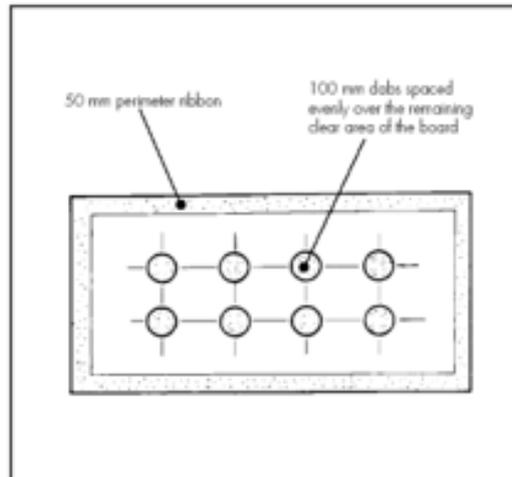
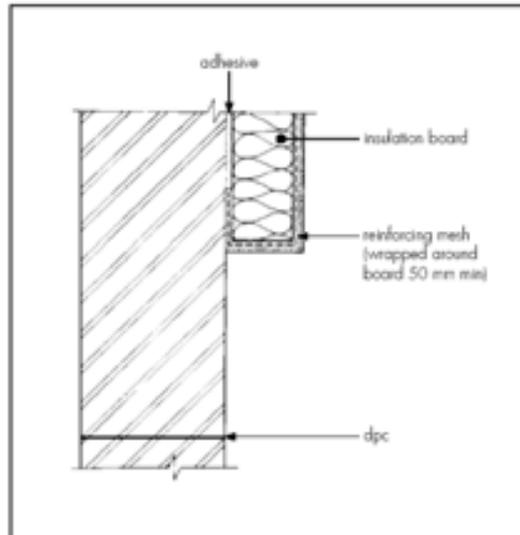
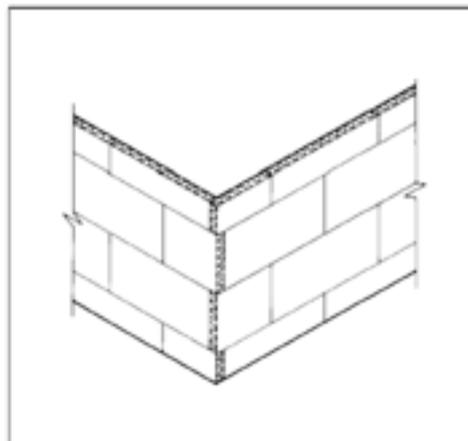


Figure 4 Typical section at base level



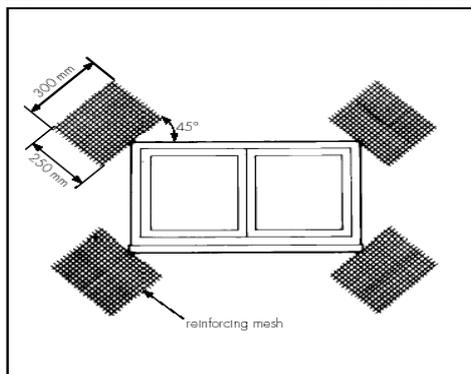
4.3.4 Subsequent rows of EPS boards are positioned so that the joints are staggered and overlapped at the building corners (see Figure 5). Care should be taken to ensure that all EPS board edges are butted tightly together, and alignment should be checked as work proceeds. Any joints in the system more than 2mm should be filled with slivers of insulation board. High spots or irregularities should be removed by lightly planing with a rasp.

Figure 5 Insulation boards corner detail



- 4.3.5 After the adhesive has dried for a minimum of 24 hours, a layer of base coat, approximately 2-3mm in thickness, is applied over the surfaces of the boards to receive the standard reinforcing mesh, which is embedded in the base coat.
- 4.3.6 Where heavy-duty mesh is required, a layer of base coat, approximately 3-4mm in thickness, is applied over the surface of the EPS boards to receive the heavy-duty mesh. The drying period for any render will depend on weather conditions; however, the base coat with heavy duty mesh embedded should be allowed to dry for at least 24 hours before application of a second layer of base coat, approximately 2-3mm in thickness. The standard mesh should be embedded in the second coat immediately.
- 4.3.7 When standard mesh is used, joint overlaps should be at least 65mm. At EPS board edges, the mesh should be wrapped around in the same way as at the base. The mesh is continued around the corner. When heavy-duty mesh is used within the first base coat, it should not be overlapped but fitted with close butt joints.
- 4.3.8 Additional reinforcing mesh should be used diagonally at the corners of openings, as shown in Figure 6.
- 4.3.9 Where corners require additional impact resistance, a corner mesh should be embedded into the adhesive base coat before the overall reinforced base coat is installed.

Figure 6 Additional reinforcement at openings

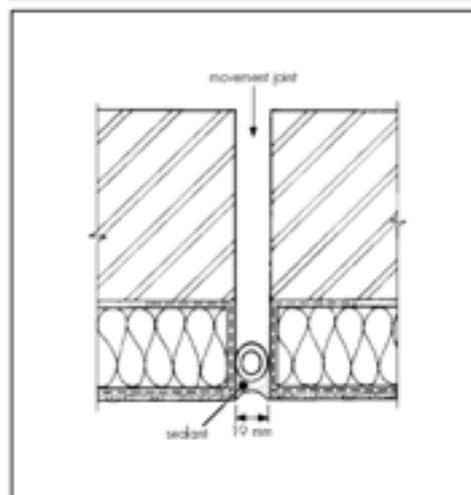


- 4.3.10 The final reinforced base coat should be left for a minimum of 24 hours to cure and should be hard, dry and free from any irregularities (trowel marks, exposed mesh, etc) before applying the surface finish.

#### 4.4 MOVEMENT JOINTS

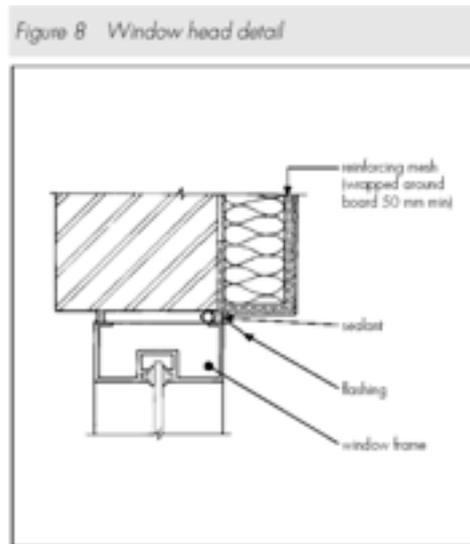
- 4.4.1 Movement joints in the substrates should be continued through the system. A vertical joint detail is shown in Figure 7.

Figure 7 Vertical movement joint detail



## 4.5 FINISHING

- 4.5.1 Taking care not to over mix, the sandblast finish should be thoroughly mixed to a smooth paste. It is applied directly over the base coat to a thickness of 1-2mm. Texturing of the surface can be carried out as required.
- 4.5.2 Care should be taken to prevent the base and finish coats from either drying too rapidly or freezing. Continuous surfaces must be completed without a break, e.g. working to a wet edge.
- 4.5.3 Care should be taken in detailing joints and seals around openings and projections (see Figure 8).



- 4.5.4 External fittings are re-fixed to the substrate after completion of the installation.
- 4.5.5 At the tops of walls, the system should be protected by an adequate overhang or by an adequately sealed purpose-made flashing.

## 5. SYSTEM SUMMARY

Insulation	SD FR grade expanded polystyrene boards 1210mm by 610mm by 100mm maximum. Nominal density 15 kgm <sup>-3</sup> , minimum cross-breaking strength 140 kPa.
Adhesive/base coat	Base Coat – latex emulsion containing aggregate, coalescing and thickening agents mixed with Portland cement in the ratio of 1:1 by mass.
Finishes	Sandblast – ready mixed. Acrylic based emulsions containing aggregate, coalescing and thickening agents.
Reinforcing mesh	Standard mesh – a woven glass-fibre mesh with a polymer coating and nominal weight of 210 gm <sup>-2</sup> and 1m wide.  Heavy-duty mesh – a woven glass-fibre mesh with a polymer coating and nominal weight of 690 gm <sup>-2</sup> and 1m wide.  Corner mesh – a woven glass-fibre mesh with a polymer coating and nominal weight of 320 gm <sup>-2</sup> .
Mechanical fixings (if required)	Prior fixed galvanized channel inserts or polypropylene or stainless steel fixings.



## 6. THERMAL PROPERTIES

Thermal conductivity      The thermal conductivity value of the insulation boards can be taken as  $0.037 \text{ Wm}^{-1}\text{k}^{-1}$ .

U values      Using values provided by EPSASA the thermal insulation values for a typical 225mm brick external wall (density  $1700 \text{ kgm}^{-3}$ ) with 10mm plasterboard:

Insulation Thickness (mm)	U value ( $\text{Wm}^{-2}\text{K}^{-1}$ )
20	0.87
40	0.59
60	0.45
80	0.36
100	0.30

## 7. IMPACT RESISTANCE

If the system may be exposed to severe malicious or mechanical impact, appropriate design measures should be considered to reduce the risk of damage.

## 8. DESIGN WIND

SANS 10160 1989 : The general procedures and loadings to be adopted in the design of buildings.

## 9. BIBLIOGRAPHY

Applicable SANS Codes are detailed in Section 5.



Page 22

## **NOTES**



## SECTION 3

### EPS NEW FLOOR INSULATION

#### CONTENTS

	<b>Page</b>
1. Introduction	24
1.1 General	24
1.2 Maintenance	24
2. Technical Specification	24
2.1 Description	24
2.2 Delivery and site handling	24
3. Design Data	25
3.1 General	25
3.2 Properties in relation to fire	25
3.3 Moisture penetration	25
3.4 Thermal Insulation	25
3.5 Floor loading	25
3.6 Durability	26
4. Installation	26
4.1 General	26
4.2 Procedure	26
4.3 Inclusion of Services	27
5. Bibliography	41
6. Drawing	29



## **EPSASA GUIDE TO INSULATE NEW FLOORS**

### **1. INTRODUCTION**

#### **1.2 GENERAL**

- 1.2.1 Expanded Polystyrene (EPS) insulation, when installed in accordance with this guide, is effective in reducing the thermal transmittance (U value) of the floors of new buildings.
- 1.2.2 EPS floor insulation is made from standard EPS boards in thicknesses and edge profiles to suite the applications.
- 1.2.3 The installation of EPS insulation during the construction of floors must be carried out by competent contractors.
- 1.2.4 EPSASA, through its members, provides technical support including application manuals and guidance on thermal performance.

#### **1.2 MAINTENANCE**

EPS floor insulation is an expanded polystyrene rigid foam board produced by EPSASA members to conform to EPSASA specifications. The EPS boards are manufactured in various thicknesses and the edges may be profiles for shiplapping. EPS boards are manufactured in a variety of lengths.

### **2. TECHNICAL SPECIFICATION**

#### **2.1 DESCRIPTION**

- 2.1.1 EPSASA Floor Boards for Concrete Ground Floors comprise of HD and EHD Grades of Expanded Polystyrene ( EPS ).
- 2.1.2 EPS Boards with flame retardant additive are always to be used.
- 2.1.3 EPS Boards are supplied in the standard sizes of 2440mm by 1220mm, 1830mm by 1220mm and 1220mm by 1220mm and are available in thicknesses from 20mm to 100mm in 5mm increments. Other thicknesses are available on request.
- 2.1.4 Tests on the finished products are regularly carried out to determine:
  - dimensional accuracy
  - compressive strength at 10% compression
  - cross breaking test to failure.

#### **2.2 DELIVERY AND SITE HANDLING**

- 2.2.1 The EPS boards are delivered to site wrapped in polythene. Each pack bears the manufacturer's trade name and the EPSASA identification mark.
- 2.2.2 The EPS boards must be protected from prolonged exposure to sunlight and should be stored either under cover or protected with opaque polythene. Care must be taken to avoid contact with solvents and with materials containing volatile organic components such as coal tar, pitch, timber newly treated with creosote, etc.
- 2.2.3 The EPS boards must be stored flat, protected from high winds and raised above damp surfaces.
- 2.2.4 The EPS boards must not be exposed to open flame or other ignition sources.

### 3. DESIGN DATA

#### 3.1 GENERAL

- 3.1.1 EPS Floor Boards for Concrete Ground Floors is effective in reducing the U-value (thermal transmittance) of new or existing floors incorporating either a cement-based screed or a chipboard overlay.
- 3.1.2 Ground supported floors incorporating the EPS boards must include a suitable damp-proof membrane laid in accordance with SANS 10021 2002 : The waterproofing of buildings.
- 3.1.3 The overlay to the EPS boards should be:
- (1) a cement-based floor screed laid in accordance with the relevant clauses of SANS 10109 Part 2, or
  - (2) chipboard in accordance with SANS 50312, or
  - (3) a concrete slab in compliance with SANS 1879 2004: Precast concrete suspended slabs.

#### 3.2 PROPERTIES IN RELATION TO FIRE

- 3.2.1 The EPS boards do not prejudice the fire resistance properties of the floor.
- 3.2.2 When properly installed the EPS boards will not add to any existing fire hazard. The EPS boards will be contained within the floor by the overlay until the overlay itself is destroyed. The EPS boards therefore will not contribute to the development stages of a fire or present a smoke or toxic hazard. Electrical cables running within the EPS boards should be separated from it by enclosing them within a suitable conduit, e.g. rigid PVC.

#### 3.3 MOISTURE PENETRATION

The EPS boards are not a water vapour controlling layer; however, they will not allow moisture to cross the floor construction provided they are installed in accordance with this Guide.

#### 3.4 THERMAL INSULATION

- 3.4.1 For the purpose of U value calculations to determine if the requirements of the Building (or other statutory) Regulations are met, the thermal conductivity ( k value) may be taken as  $0.035 \text{ Wm}^{-1}\text{K}^{-1}$  for HD and  $0.032 \text{ Wm}^{-1}\text{K}^{-1}$  for EHD EPS boards.
- 3.4.2 The requirements for limiting heat loss through the building fabric can be satisfied if U values of the building elements, including the effect of thermal bridging do not exceed the maximum values in the relevant calculation method.

#### 3.5 FLOOR LOADING

- 3.5.1 The design loadings for floors should be:

	Domestic	non-Domestic
intensity of distributed load (kPa)	1.5	2.5
concentrated load (kN)	1.4	2.7

- 3.5.2 The EPS boards covered with chipboard or screed can support these design loadings without undue deflection.
- 3.5.3 A BRE survey of imposed floor loading in domestic buildings (see BRE current paper No 2/77 Floor loadings in domestic buildings – the results of a survey) indicates that loadings in flats are commonly in the region of 0.6 kPa and loadings of 1.5 kPa are normally associated with fixed items.



3.5.4 Where the EPS boards are used under a concrete slab, resistance to concentrated and distributed loads is a function of the slab specification.

### **3.6 DURABILITY**

The EPS boards are rot-proof, dimensionally stable and, when installed with the overlays specified in this Guide, will remain effective as an insulating material for the life of the building in which they are incorporated.

## **4. INSTALLATION**

### **4.1 GENERAL**

4.1.1 Typical methods of installation for EPS Floor Insulation for Concrete Ground Floors are shown in Figure 1.

4.1.2 The concrete floor over which the EPS boards are to be laid should be left as long as possible to maximize drying out of moisture. The floor surface should be smooth and flat to within 5mm when measured with a 3 metre straight edge, e.g. when concrete is laid on site it should be in accordance with SANS 10109-1 1995: Concrete floors part 1 – bases for concrete floors. Irregularities (up to 10mm) may be leveled with mortar.

4.1.3 The EPS boards can also be used on a beam and block suspended concrete floor. The surface of the floor should be smooth and flat to within 5mm when measured with a 3 metre straight edge. Irregularities greater than this must be removed.

4.1.4 Where the EPS boards are used over ground-supported concrete floor slabs they should incorporate a suitable damp-proof membrane, in accordance with SANS 10021, to resist moisture from the ground. If a liquid type damp-proof membrane is applied to the slabs, it should be of a type compatible with expanded polystyrene and be allowed to dry out fully before laying the EPS boards.

4.1.5 Where the EPS boards are used on hardcore bases under ground-supported concrete slabs, the hardcore must be blinded before application of the EPS boards.

4.1.6 Where a screed or concrete slab is laid over the EPS boards, vertical upstands of insulation should be provided and be of sufficient depth to fully separate the screed or slab from the wall.

4.1.7 During construction, the EPS boards and overlays must be protected from damage by moisture from sources such as water spillage, plaster droppings and traffic. Before laying EPS boards above a slab, care should be taken to ensure sufficient time for the dissipation of constructional moisture.

#### **4.1.8 Exposed or semi-exposed intermediate timber floors**

Before installing the EPS boards, the floor should be inspected thoroughly for possible defects and its condition should meet the recommendations of SANS 10109 Part 2. The surface of the floor should be smooth and flat to within 5mm when measured with a 3 metre straight-edge

### **4.2 PROCEDURE**

4.2.1 The EPS boards are cut to size, as necessary, and laid with closely butted, taped joints.

#### **4.2.2 Cement-based screed overlay**

Perimeter edge pieces are cut and placed around the edges. A properly compacted screed of at least 65mm is laid. The relevant clauses of SANS 10109 Part 2 will apply.



#### 4.2.3 **Chipboard overlay**

Before laying the EPS boards, preservative treated battens are positioned at doorways and to support partitions. Adequate time should be allowed for CCA based preservatives to become fixed, and for the solvents from solvent-based preservatives to evaporate.

4.2.4 Where EPS boards are laid on a dpm, a vapour check consisting of 0.25mm (250 micron) polyethylene sheet, is laid between the EPS boards and the chipboard. The polyethylene sheet has 150mm overlaps taped at the joints and is turned up 100mm at the walls.

4.2.5 The selection of chipboard/particle board must be in accordance with SANS 50312.

4.2.6 An expansion gap between the chipboard and the perimeter walls should be provided at the rate of 2mm per metre run or a minimum of 10mm, whichever is the greater.

4.2.7 Where there are long, uninterrupted lengths of floor, e.g. corridors, proprietary expansion joints should be installed at intervals on the basis of a 2mm gap per metre run of chipboard.

4.2.8 Before the chipboard panels are interlocked, either a PVA or mastic adhesive is applied to the joint.

4.2.9 Once the chipboard is laid, temporary wedges are inserted between the walls and the floor to maintain tight joints until the adhesive has set.

4.2.10 To prevent cold-bridging a suitable compressible filler, e.g. pieces of expanded polystyrene, should be fitted around the perimeter of the floor between the chipboard and the walls when the wedges are removed and before the skirting boards are affixed.

4.2.11 Where there is a likelihood of regular water spillage, e.g. in rooms such as kitchens, bathrooms, shower and utility rooms, additional chipboard protection should be considered, for example a continuous flexible vinyl sheet flooring with welded joints and cove skirtings.

#### 4.2.12 **Cement-based screed overlay**

Perimeter edge pieces are cut and placed around the edges and taped at joints. The concrete slab is laid to the required thickness.

### 4.3 **INCLUSION OF SERVICES**

4.3.1 The maximum continuous working temperature of the EPS boards is 80°C. The EPS boards must not be used in direct contact with electrical heating cables or hot water pipes.

#### 4.3.2 **Suspended beam and block floors**

Where the EPS boards are installed on a floor of a suspended beam and block design, all services must be installed in accordance with the Agrément Certificate for that floor.

#### 4.3.3 **Other types of floor**

Where possible, electrical conduits, gas and water pipes or other services should be contained within ducts or channels within the concrete slab. Where this is not possible, the services may be accommodated within the insulation, provided they are securely fixed to the concrete slab. Electrical cables should be enclosed in suitable conduit. With hot pipes the insulation must be cut back to maintain an air space.

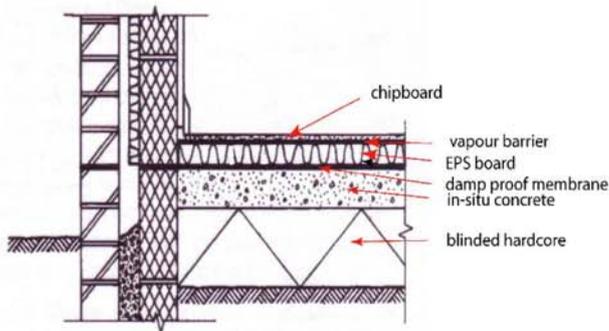


- 4.3.4 Where water pipes are installed, either within the slab or the EPS boards, they must be pre-lagged.
- 4.3.5 For floors incorporating chipboard overlays, where access to the services is desirable, a duct may be formed by mechanically fixing to the floor, timber bearers of the same thickness as the insulation to provide support for a chipboard cover. The duct should be as narrow as possible and not exceed the maximum chipboard spans recommended.
- 4.3.6 **Timber intermediate floors**  
All the services should be incorporated beneath the existing floor.

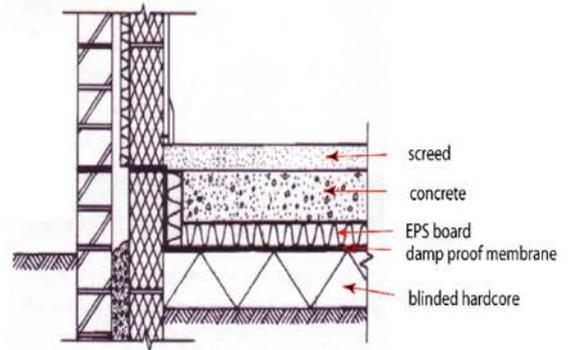
## 5. **BIBLIOGRAPHY**

Applicable SANS Codes are detailed in Section 5.

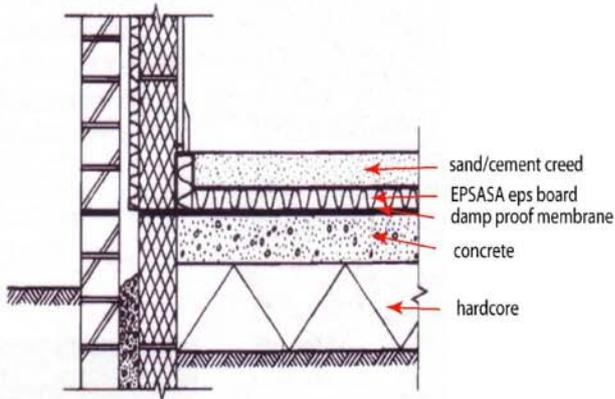
Figure 1 Typical installation details



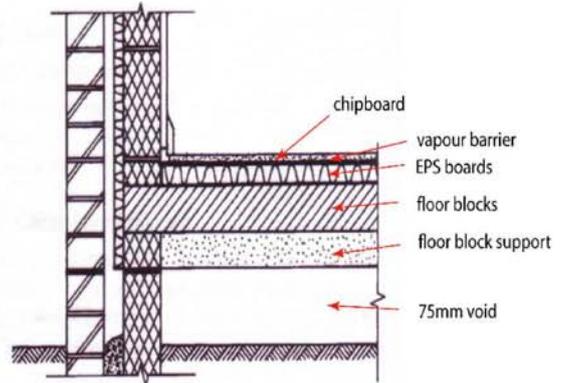
(a) chipboard



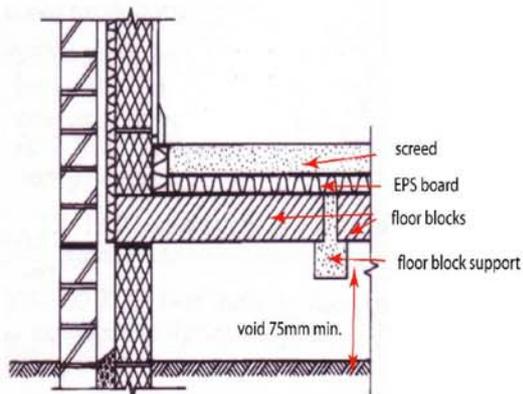
(b) concrete sub-floor



(c) floating screed



(d) suspended floor - chipboard



(e) suspended floor - screed



**NOTES**



## SECTION 3

### EPS ROOF SLAB INSULATION

#### CONTENTS

	<b>Page</b>
1. Introduction	32
1.1 General	32
1.2 Manufacture	32
2. Technical Specification	32
2.1 Description	32
2.2 Delivery to site and storage	34
3. Design Data	34
3.1 General	34
3.2 Resistance to foot traffic	34
3.3 Resistance to plant growth and insects	34
3.4 Properties in relation to fire	35
3.5 Effect on roof coverings	35
3.6 Thermal Insulation	35
3.7 Condensation risk	35
3.8 Maintenance / upgrading	35
3.9 Durability	36
4. Installation	36
4.1 General	36
4.2 Procedure	36
4.3 Protective finishes	38
5. Bibliography	41

## EPS ROOF SLAB INSULATION

### 1. INTRODUCTION

#### 1.1 GENERAL

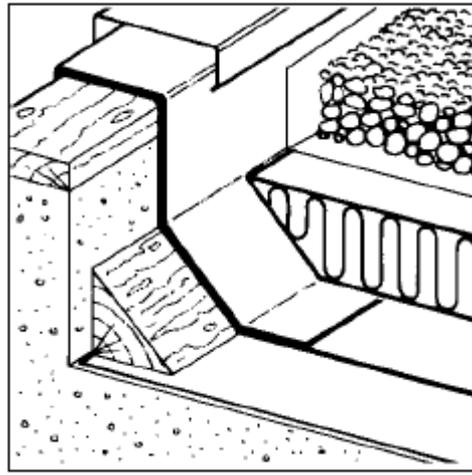
Expanded Polystyrene (EPS) insulation, when installed in accordance with this guide, is effective in reducing the thermal transmittance (U value) of the roofs of new and existing buildings.

- 1.1.1 EPS roof insulation is made from standard EPS boards in thicknesses and edge profiles to suit the applications.
- 1.1.2 The installation of EPS insulation during the construction of roofs must be carried out by competent contractors.
- 1.1.3 EPSASA, through its members, provides technical support including application manuals and guidance on thermal performance.

#### 1.2 MANUFACTURE

EPS cavity wall insulation is an expanded polystyrene rigid foam board produced by EPSASA members to conform to EPSASA specifications. The EPS boards are manufactured in various thicknesses and the edges may be profiled for shiplapping. EPS boards are manufactured in a variety of lengths.

### 2. TECHNICAL SPECIFICATION

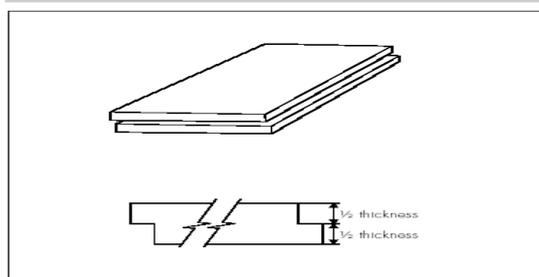


#### 2.1 DESCRIPTION

- 2.1.1 Expanded Polystyrene (EPS) Roofboards, grades HD and EHD, are manufactured by EPSASA members to conform to EPSASA specifications. All EPS grades manufactured by EPSASA members contains Fire Retardant additive and are manufactured without the use of CFC/HCFC. The EPS board is cut to size and the edges may be rebated to the center (see Figure 1).

(typical rebate detail)

*Figure 1 Rebate detail*

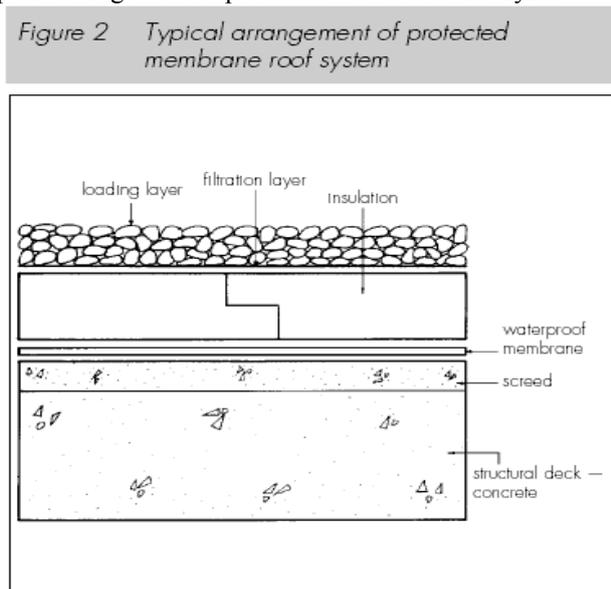


2.1.2 The protected membrane roof system incorporates an EPS board above a waterproofing membrane, i.e. an upside-down or inverted configuration (see Figure 2).

2.1.3 Nominal characteristics of the EPS boards are given in Table 1.

2.1.4 The EPS boards must be covered by one of the protective finishes described in section 4.3 of this Guide, depending on the access to the roof, wind effects, etc.

Figure 2 : Typical arrangement of protected membrane roof system



(Breathable membrane) ?

Table 1 : Nominal characteristics		
Characteristic (units)	Roofboard HD	Roofboard EHD
Thermal conductivity ( $Wm^{-1}K^{-1}$ ) (at 10°C mean temperature)	0.035	0.032
Compressive strength	110	200
Work size (mm)	1250 x 600	1250 x 600
Overall size (mm)	1265 x 615	1265 x 615
Rebate size (mm)	15 x ½ board thickness	15 x ½ board thickness
Standard Thickness (mm)	35, 50, 60, 75 and 100	50, 75 and 100

2.1.5 A range of accessories is available but these have not been assessed by EPSASA and are not covered by this Guide. A list of suppliers can be obtained from the manufacturer of the EPS Boards. The range includes:

- dual-level rainwater outlets
- paving supports
- filter layer
- separation layer
- flashings

2.1.6 Quality control is maintained by regular EPSASA testing. EPS boards are checked visually and measured for dimensional accuracy by the supplier. Samples are taken at regular intervals to check:

- compressive strength
- density
- flexural strength
- thermal conductivity
- presence of flame retardant additive



## **2.2 DELIVERY TO SITE AND STORAGE**

2.1.1 The EPS boards are delivered to site wrapped in polythene film. Each pack bears a label incorporating the EPSASA identification mark and the following details:

- board dimensions and type of edge profile
- number of boards in pack
- grade of insulation
- manufacturer's reference codes.

2.2.2 EPS boards must be protected from prolonged exposure to sunlight by either storage under cover or covering with light-coloured, opaque polythene sheets.

2.2.3 Care must be taken to prevent contact with solvent-based wood preservatives, coal tar and derivatives (e.g. creosote), paint thinner and solvents (e.g. toluene, white spirit).

2.2.4 EPS boards must not be exposed to naked flame or other ignition sources.

## **3. DESIGN DATA**

### **3.1 GENERAL**

3.1.1 Roofboard HD and EHD are for use in the protected membrane roof system as a thermal insulation layer on limited access flat roofs. The deck must be concrete, new or existing and structurally capable of carrying all expected additional loads of the insulation system. Structural integrity verification must be done by others and is outside of the scope of this guide.

3.1.2 Limited access roofs are defined for the purpose of this Guide as those roofs subjected only to pedestrian traffic for maintenance of the roof covering and cleaning of gutters, etc. Where traffic in excess of this is envisaged, special precautions such as the use of additional protection to the membrane must be taken.

3.1.3 Flat roofs are defined for the purpose of this Guide as those roofs having a minimum finished fall of 1:80. Pitched roofs are defined as those having falls in excess of 1:6.

3.1.4 Where there is a risk from plasticiser migration or other contaminants from the roof waterproofing, a suitable plastic fibre, or similar, isolating sheet must be interposed between the roof covering and the EPS boards in accordance with the manufacturer's instructions.

### **3.2 RESISTANCE TO FOOT TRAFFIC**

3.2.1 When covered with one of the protection systems described in section 4.3 the system can accept, without damage, the limited foot traffic and light concentrated loads associated with installation and maintenance operations.

3.2.2 Where regular foot traffic is envisaged, i.e. access to lift motor rooms, walkways of paving on suitable supports must be provided. Where such traffic cannot be controlled, paving slabs must be used as the loading medium, placed on a bed of washed gravel 20mm thick to assist drainage.

### **3.3 RESISTANCE TO PLANT GROWTH AND INSECTS**

3.3.1 The EPS board, when covered with one of the protection systems described in section 4.3, will not normally support the growth of plants. However, where there is a run-off from a large sill or gully onto the surface of the roof, the excessive build-up of silt may provide conditions for germination of seeds. Therefore, this type of detail should be avoided.



3.3.2 Small insects may be found under the EPS board, they will neither attack nor have any effect on the performance or durability of the roof.

### **3.4 PROPERTIES IN RELATION TO FIRE**

3.4.1 When the EPS boards are used in the protected membrane roof system, and ballasted with aggregate (minimum depth of 50mm), or covered with paving slabs, the fire performance of the roof may be considered satisfactory.

### **3.5 EFFECT ON ROOF COVERINGS**

The protected membrane roof system will provide solar protection and also limit the range of temperature to which the waterproofing membrane will be subjected. Placing the insulation on top of the roof covering will normally lead to an extended life, provided the top layer of the membrane is strengthened with a durable reinforcement (e.g. glass fibre and/or polyester).

### **3.6 THERMAL INSULATION**

3.6.1 For the purpose of U value calculations to determine if the requirements of the building regulations, or other regulations, are met, the thermal conductivity (k value) of the boards may be taken as:

- Roofboard HD –  $0.035 \text{ Wm}^{-1}\text{K}^{-1}$
- Roofboard EHD –  $0.032 \text{ Wm}^{-1}\text{K}^{-1}$

3.6.2 Building regulations in South Africa are in the process of revision to include thermal performance.

3.6.3 Water absorption slightly affects the rate of loss of heat of the roof systems but once it has stopped, the normal heat loss pattern of the roof resumes. To compensate for any adverse effect the k values allow for a 20% increase in thermal conductivity.

3.6.4 If a cushion layer, e.g. foamed polyethylene, is incorporated between the waterproofing membrane and the EPS boards, the effect of rainfall on the thermal insulation is likely to be slightly reduced.

### **3.7 CONDENSATION RISK**

3.7.1 Warm water trapped under the EPS board is likely to be replaced by colder water when it is raining. Therefore, during heavy or continuous rainfall the roof waterproofing and the deck will be cooled and if condensation does occur it will be temporary and disappear when the rain stops.

3.7.2 Interstitial condensation will not be a problem with concrete decks, but metal and timber decks will be subjected to short periods of moisture; therefore timber must be treated with a suitable preservative.

### **3.8 MAINTENANCE / UPGRADING**

3.8.1 The protected membrane roof system should require little or no maintenance other than annual removal of any plants and checking that the gravel loading, if used, has not been displaced, and is not blocking a gully.

3.8.2 If a leak should occur in the roof waterproofing, access is achieved by removal of the surface protection and the EPS boards.

3.8.3 Protected membrane roofs are able to accept upgrading of the thermal insulation at a later date without difficulty provided there is sufficient height to parapets, rooflights, etc. Where there is insufficient height, they must be modified to accommodate the additional thickness. More loading may be needed and it must be established that the deck can support it.



- 3.8.4 If upgrading involves laying EPS boards on top of the existing EPS boards, rather than replacement with thicker EPS boards, the advice of the EPSASA should be sought.

### 3.9 DURABILITY

- 3.9.1 The EPS boards are unaffected by freeze / thaw cycles and water.
- 3.9.2 The protected membrane roof system will have a life of at least 20 years under normal circumstances, when a finish of gravel, paving or concrete is used.
- 3.9.3 New roof coverings, on which the EPS boards are laid, can be expected to have a life in excess of that obtained when they are used in an exposed situation.
- 3.9.4 When used to upgrade existing roofs, the system can be expected to extend the remaining life of the roof waterproofing, provided it is in a sound condition when the EPS boards are laid.

## 4. INSTALLATION

### 4.1 GENERAL

- 4.1.1 Decks must be designed to take account of the loads imposed by the heavy protective finishes described in section 4.3.
- 4.1.2 Decks must be covered by waterproofing membranes of acceptable quality which must be laid in accordance with the manufacturers specifications and the recommendations of SANS 10021. The waterproofing of buildings.
- 4.1.3 If a separation sheet or a cushion layer is being used, this is loose laid and one layer of EPS roofboard is laid in accordance with the manufacturer's instructions.
- 4.1.4 It is essential that all joints between EPS boards are tight and no gaps exist where they meet rooflights, verges, upstands, edge details and other services which perforate the roof deck. Where required, the EPS boards can be cut easily to prevent thermal bridging.
- 4.1.5 EPS boards may be installed in any weather but, due to their lightweight, care will be needed in high winds. Installers must not carry EPS boards near to parapets or apertures in the deck and, once placed, the EPS boards must be loaded immediately.
- 4.1.6 None of the heavy protections should be piled or stacked in one place on the roof deck unless it is strong enough to carry the loads.
- 4.1.7 Rainwater outlets must be at both levels to accept water from the top of the installation and the membrane. Verges and upstands, including rooflight kerbs must be sufficiently high to contain the insulation and loading layer. Modification to existing roofs may be necessary.

### 4.2 PROCEDURES

#### 4.2.1 NEW CONSTRUCTIONS (Figures 3, 4, 5 and 6)

- a. It is essential to establish that the roof waterproofing has been installed correctly and that it is weathertight. Every joint between sheets, flashing details, etc must be checked to ensure that the roof covering is suitable for a protected membrane roof specification. Single layer roofings must be the subject of very close scrutiny, and the inspection must include an examination for perforation and for the likelihood of subsequent perforation from beneath by uneven decks, protruding nail head's etc.

Figure 3 Gully detail – two-level drainage

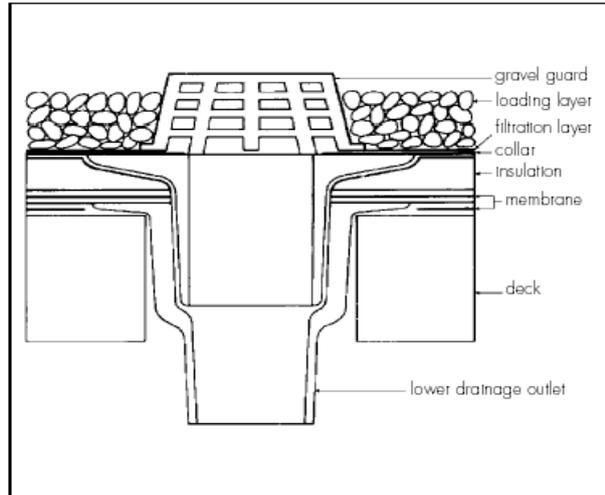


Figure 4 Parapet roof deck detail – tanking specification

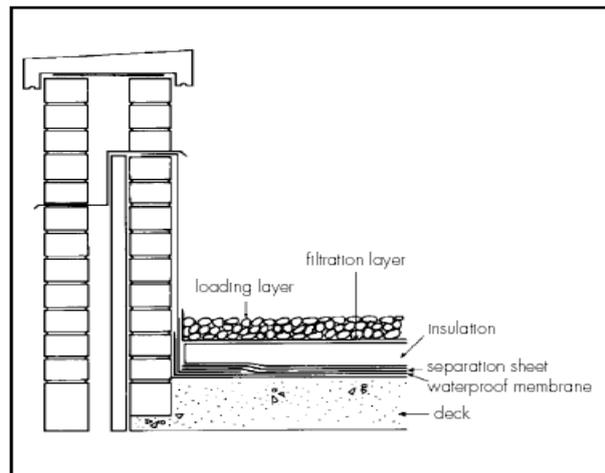


Figure 5 Parapet roof deck detail – bituminous waterproofing membrane

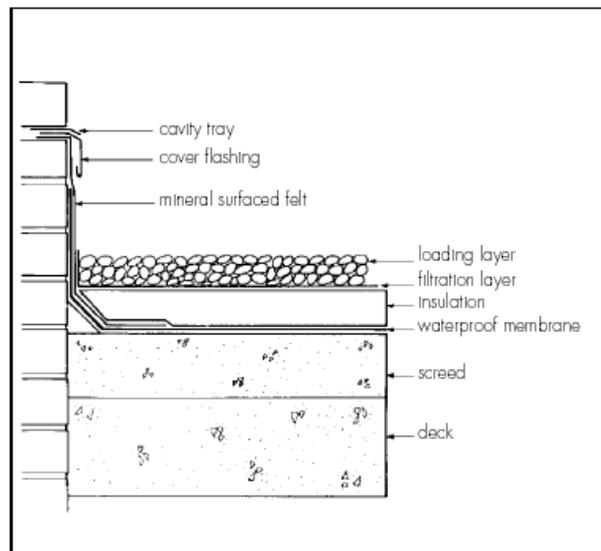
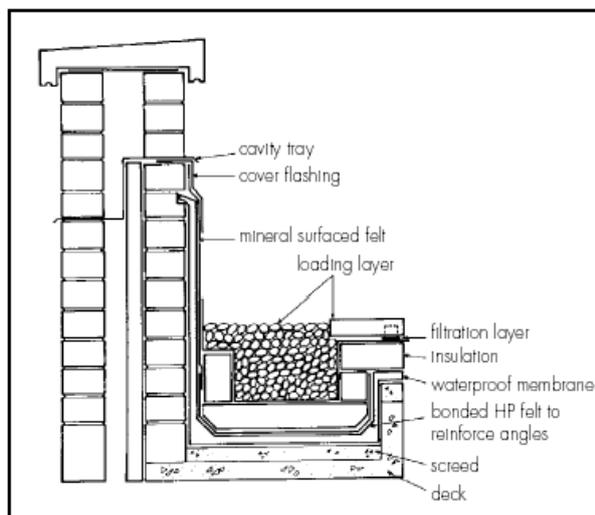


Figure 6 Parapet roof deck gutter detail (mastic asphalt)



- b. The roof covering must be clean and free from any extraneous matter.
- c. When a single layer loose-laid waterproofing membrane or tanking specification is used, a cushion layer should be interposed between the membrane and the roof deck, and a filter layer should be interposed between the EPS boards and the ballast.
- d. When a tanking specification waterproofing membrane is used, a separation layer should be interposed between the membrane and the EPS, and a filter layer between the insulation boards and the ballast.
- e. When the EPS boards are installed they should be ballasted as soon as possible to protect the membrane, if loose laid, from the effects of wind uplift and to protect the EPS boards from solar degradation.
- f. Installers must take care not to damage the roof waterproofing, particularly in the case of thin single layer membranes.

#### 4.2.2 UPGRADING EXISTING CONSTRUCTIONS

- a. All the requirements detailed in sections 4.2.1 apply and, in addition, the existing roofing and substructure must be examined for degradation and, where necessary, repairs effected.
- b. Where parapets, details, services, etc have insufficient height to accommodate the increased depth of insulation/protection, due provisions need to be made (i.e. a minimum of 150mm from the top of the gravel to the top of skirtings, etc).
- c. Rainwater outlets will need to be modified or replaced to suit, e.g. by the installation of gravel guards.

### 4.3 PROTECTIVE FINISHES

- 4.3.1 To prevent flotation, wind uplift and UV degradation the 50mm thick EPS board must be loaded with a 50mm deep layer of washed rounded gravel, nominal size 20mm to 40mm, or washed broken stone of similar size. Thicker EPS board requires a thicker layer of gravel, usually the same thickness as the insulation.
- 4.3.2 It is essential that the depth and size of gravel are such that complete cover and protection is afforded to the EPS boards.



- 4.3.3 The proportion of fines in the aggregate should be kept to a minimum to prevent the risk of gullies being blocked and to discourage organic growth.
- 4.3.4 With single membrane roof waterproof coverings or tanking specifications, only washed well-rounded aggregate of nominal diameter 20mm to 40mm should be used. In addition a non-woven, vapour-permeable polyester filter sheet must be placed between the aggregate and the EPS boards to prevent fine grit getting underneath, where it might damage the membrane or block the rainwater gullies.
- 4.3.5 The dead load imposed by 50mm of gravel is approximately  $80 \text{ kgm}^{-2}$ , therefore the deck must be capable of withstanding this as well as any additional loads.
- 4.3.6 This gravel loading specification is used on roofs in sheltered regions or low to medium-rise buildings up to 10 storeys. When laid in moderate exposure zones, or on buildings of up to 15 storeys, the gravel specification is permitted but the perimeter should be loaded with paving. For severe exposure zones or tall buildings, specialist advice should be sought. SANS 10160 provides technical specifications if required.

#### 4.3.7 PAVING SLABS

- a) Depending on access to the roof, wind effects, etc the following arrangements should be used:
- (1) standard pressed concrete paving slabs on appropriate spacers, but see section (b), or
  - (2) standard pressed concrete paving slabs or paving bricks on 20mm depth of either gravel graded 4mm to 8mm, on a slip sheet of non-woven synthetic fibre fleece or fine polyethylene mesh, aperture 2mm or less.
- b) The paving should have a minimum thickness of 40mm on EPS boards 50mm thick, and 50mm on EPS boards 75mm thick to prevent flotation of the boards in the event of accidental blockage of the rainwater outlets.
- c) The deck must carry safely the additional load of approximately  $100 \text{ kgm}^{-2}$  for the 40mm thick slabs or  $125 \text{ kgm}^{-2}$  for the 50mm thick slabs.
- d) The method of laying and bedding will depend upon the form of the roof and the manufacturer's advice should be sought.

#### 4.3.8 CONCRETE

- a) A concrete screed is cast, in accordance with SANS 10109 Part 2, on building paper laid over a 25mm thick drainage layer of 6mm pea gravel on a non-woven synthetic fleece.
- b) The additional load imposed by this protection can be calculated on the basis that every 10mm of thickness will load the roof deck by about  $25 \text{ kgm}^{-2}$ .
- c) In addition, the drainage layer will impose a load of about  $40 \text{ kgm}^{-2}$ .

## 5. BIBLIOGRAPHY

Applicable SANS Codes are detailed in Section 5.



Page 40

## **NOTES**



## **SECTION 5**

Relevant Specifications      Page 41

Membership Role              Page 43



## RELEVANT SPECIFICATIONS

1. ARP001 1987: The application of SABS 0157 Part 1 or 2 within the structural steel industry
2. SANS 28:1986 : Metal Ties for Cavity Walls
3. SANS 92 1981 : Bituminous roofing felt
4. SANS 0145:2000 Concrete masonry construction
5. SANS 0164-1:1980 The structural use of masonry Part 1: Un-reinforced masonry walling
6. SANS 248 : 1973 : Bituminous damp-proof courses
7. SANS 0249:1993 Masonry walling
8. SANS 286 1973: Bituminous damp-proof courses
9. SANS 297 1975 : Mastic asphalt for roofing
10. SANS 298 1975 : Mastic asphalt for damp-proof courses and tanking
11. SANS 581 1999 : Semi-flexible vinyl floor tiles
12. SANS 586 1992 : Resin modified vinyl floor tiles
13. SANS 786 2000 : Flexible vinyl flooring
14. SANS 952 1985: Polyolefin film for damp- and water-proofing in buildings
15. SANS 1024 1991: Welded steel fabric for reinforcement of concrete
16. SANS 1288 2000 : Preservative-treated timber
17. SANS 1508 1990: Expanded polystyrene thermal insulation boards
18. SANS 1879 2004 : Precast concrete suspended slabs
19. SANS 1931 2003 : Particle boards – Highly moisture resistant exterior type
20. SANS 2394 2003 : General principles on reliability for structures
21. SANS 10005 1999 : The preservative treatment of timber
22. SANS 10021 2002 : The water-proofing of buildings (including damp-proofing and vapour barrier installations)
23. SANS 10070 1991 : The installation of resilient thermoplastic and similar flexible floor covering materials
24. SANS 10109-1 1995 : Concrete floors Part 1 – Bases for concrete floors
25. SANS 10109-2:2004 Concrete floors Part 2: Finishes to concrete floors covers general principles for commonly used floor finishes of certain types.
26. SANS 10160 1989: The general procedures and loadings to be adopted in the design of buildings
27. SANS 10161 1980 : The design of foundations for buildings
28. SANS 10163-1 2003 : The structural use of timber Part 1: Limit-states design



29. SANS 10163-2 2001 : The structural use of timber Part 2: Allowable stress design
30. SANS 10163-3 2004 : The manufacture and erection of timber trusses
31. SANS 10164-2:2003 The structural use of masonry Part 2: Structural design and requirements for reinforced and prestressed masonry
32. SANS 10177-5: Fire Testing of Materials, Components and Elements used in Buildings
33. SANS 10237 1991 : Roof and side cladding
34. SANS 11600 (SABS ISO 11600) 1993 : Building construction : Sealants : Classification and requirements
35. SANS 50312-1 (SABS EN 312-1) 1996 : Particle boards – Specification Part 1: General requirements for all board types
36. SANS 50312-2 (SABS EN 312-2) 1996 : Particle boards – Specification Part 2: Requirements for general purpose boards for use in dry conditions
37. SANS 50312-3 (SABS EN 312-3) 1996 : Particle boards – Specification Part 3: Requirements for boards for interior fitment (including furniture) for use in dry conditions
38. SANS 50312-4 (SABS EN 312-4) 1996 : Particle boards – Specification Part 4: Requirements for load bearing boards for use in dry conditions
39. SANS 50312-5 (SABS EN 312-5) 1996 : Particle boards – Specification Part 5: Requirements for load bearing boards for use in humid conditions
40. SANS 50312-6 (SABS EN 312-6) 1996 : Particle boards – Specification Part 6: Requirements for heavy duty loadbearing boards for use in dry conditions
41. SANS 50312-7 (SABS EN 312-7) 1997 : Particle boards – Specification Part 6: Requirements for heavy duty loadbearing boards for use in humid conditions



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