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Agrément Certificate
09/4688
Product Sheet 1

PARALON TOTAL ROOF WATERPROOFING SYSTEMS

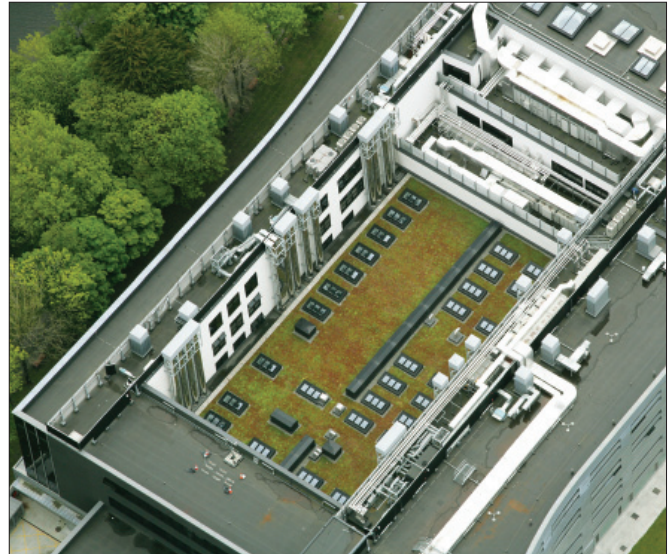
PARALON TOTAL WARM ROOF SYSTEM

This Agrément Certificate Product Sheet⁽¹⁾ relates to the Paralon Total Warm Roof System, a range of polymer-modified bitumen waterproofing membranes, insulation boards and a vapour control layer for use on flat and pitched roofs with limited or pedestrian access and with suitable protection.

(1) Hereinafter referred to as 'Certificate'.

CERTIFICATION INCLUDES:

- factors relating to compliance with Building Regulations where applicable
- factors relating to additional non-regulatory information where applicable
- independently verified technical specification
- assessment criteria and technical investigations
- design considerations
- installation guidance
- regular surveillance of production
- formal three-yearly review.



KEY FACTORS ASSESSED

Weathertightness — the system will resist the passage of moisture to the interior of the building (see section 6).

Thermal performance — the system can be used to improve the thermal performance of a roof (see section 7).

Condensation risk — roofs incorporating the system will adequately limit the risk of interstitial and surface condensation (see section 8).

Properties in relation to fire — in the opinion of the BBA, the system, when used in a suitable specification, will enable a roof to be unrestricted under the Building Regulations (see section 9).

Resistance to wind uplift — the system will enable a roof to be unrestricted under Building Regulations (see section 10).

Resistance to foot traffic — the system will accept, without damage, the limited foot traffic and loads associated with installation and maintenance (see section 11).

Durability — under normal service conditions the system will provide a durable waterproof covering with a service life in excess of 30 years (see section 13)

The BBA has awarded this Certificate to the company named above for the system described herein. This system has been assessed by the BBA as being fit for its intended use provided it is installed, used and maintained as set out in this Certificate.

On behalf of the British Board of Agrément

Simon Wroe
Head of Approvals — Materials

Greg Cooper
Chief Executive

Date of Second issue: 12 April 2013

Originally certified on 14 October 2009

The BBA is a UKAS accredited certification body — Number 113. The schedule of the current scope of accreditation for product certification is available in pdf format via the UKAS link on the BBA website at www.bbacerts.co.uk

Readers are advised to check the validity and latest issue number of this Agrément Certificate by either referring to the BBA website or contacting the BBA direct.

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Regulations

In the opinion of the BBA, the Paralon Total Warm Roof System, if installed, used and maintained in accordance with this Certificate, will meet or contribute to meeting the relevant requirements of the following Building Regulations (the presence of a UK map indicates that the subject is related to the Building Regulations in the region or regions of the UK depicted):



The Building Regulations 2010 (England and Wales) (as amended)

Requirement:	B4(2)	External fire spread
Comment:		On a suitable substructure, the use of the system will enable a roof to be unrestricted under this Requirement. See section 9 of this Certificate.
Requirement:	C2(b)	Resistance to moisture
Comment:		The system, including joints, will enable a roof to meet this Requirement. See section 6.1 of this Certificate.
Requirement:	C2(c)	Resistance to moisture
Comment:		The vapour control layer component of the system can contribute to enabling a roof to satisfy this Requirement. See sections 8.1, 8.3 and 8.4 of this Certificate.
Requirement:	L1(a)(i)	Conservation of fuel and power
Comment:		The system is acceptable. See sections 7.2 and 7.3 of this Certificate.
Regulation:	7	Materials and workmanship
Comment:		The system is acceptable. See section 13.1 and the <i>Installation</i> part of this Certificate.
Regulation:	26	CO₂ emission rates for new buildings
Comment:		The system can enable a construction to meet the requirements of this Regulation. See sections 7.2 and 7.3 of this Certificate.



The Building (Scotland) Regulations 2004 (as amended)

Regulation:	8(1)(2)	Fitness and durability of materials and workmanship
Comment:		The use of the system satisfies the requirements of this Regulation. See sections 12, 13.1 and the <i>Installation</i> part of this Certificate.
Regulation:	9	Building standards applicable to construction
Standard:	2.8	Spread from neighbouring buildings
Comment:		The system, when applied to a suitable substructure, is regarded as having low vulnerability under clause 2.8.1 ⁽¹⁾⁽²⁾ of this Standard. See sections 9.1, 9.2 and 9.4 of this Certificate.
Standard:	3.10	Precipitation
Comment:		The use of the system, including joints, will enable a roof to meet the requirements of this Standard, with reference to clauses 3.10.1 ⁽¹⁾⁽²⁾ and 3.10.7 ⁽¹⁾⁽²⁾ . See section 6.1 of this Certificate.
Standard:	3.15	Condensation
Comment:		The vapour control layer component of the system will enable a roof to satisfy this Standard, with reference to clauses 3.15.1 ⁽¹⁾ , 3.15.3 ⁽¹⁾ , 3.15.5 ⁽¹⁾ and 3.15.6 ⁽¹⁾ . See sections 8.1, 8.3 and 8.5 of this Certificate.
Standard:	6.1	Carbon dioxide emissions
Standard:	6.2	Building insulation envelope
Comment:		The system can contribute to satisfying the requirements of these Standards, with reference to all or parts of clauses 6.1.2 ⁽²⁾ , 6.1.6 ⁽¹⁾ , 6.2.1 ⁽¹⁾⁽²⁾ , 6.2.3 ⁽¹⁾ , 6.2.4 ⁽²⁾ , 6.2.5 ⁽²⁾ , 6.2.6 ⁽¹⁾ , 6.2.7 ⁽¹⁾ , 6.2.8 ⁽¹⁾⁽²⁾ , 6.2.9 ⁽¹⁾⁽²⁾ , 6.2.10 ⁽¹⁾⁽²⁾ , 6.2.11 ⁽¹⁾⁽²⁾ , 6.2.12 ⁽²⁾ and 6.2.13 ⁽¹⁾⁽²⁾ . See sections 7.2 and 7.3 of this Certificate.
Standard:	7.1(a)(b)	Statement of sustainability
Comment:		The system can contribute to meeting the relevant requirements of Regulation 9, Standards 1 to 6 and therefore will contribute to a construction meeting a bronze level of sustainability as defined in this Standard. In addition, the system can contribute to a construction meeting a higher level of sustainability as defined in this Standard, with reference to clauses 7.1.4 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾], 7.1.6 ⁽¹⁾⁽²⁾ [Aspects 1 ⁽¹⁾⁽²⁾ and 2 ⁽¹⁾] and 7.1.7 ⁽¹⁾⁽²⁾ [Aspect 1 ⁽¹⁾⁽²⁾]. See sections 7.2 and 7.3 of this Certificate.
Regulation:	12	Building standards applicable to conversions
Comment:		All comments given for the system under Regulation 9, Standards 1 to 6, also apply to this Regulation, with reference to clause 0.12.1 ⁽¹⁾⁽²⁾ and Schedule 6 ⁽¹⁾⁽²⁾ . (1) Technical Handbook (Domestic). (2) Technical Handbook (Non-Domestic).



The Building Regulations (Northern Ireland) 2012

Regulation:	23(a)(i)(iii)(b)	Fitness of materials and workmanship
Comment:		The system is acceptable. See section 13.1 and the <i>Installation</i> part of this Certificate.
Regulation:	28(b)	Resistance to moisture and weather
Comment:		Tests for water resistance indicate that the system membranes, including joints, meet the requirements of this Regulation. See section 6.1 of this Certificate.
Regulation:	29	Condensation
Comment:		The system can contribute to a roof meeting this Regulation. See sections 8.1 and 8.3 of this Certificate.

Regulation:	36(b)	External fire spread
Comment:	Tests indicates that on suitable substructures, the use of the system will enable a roof to be unrestricted under the requirements of this Regulation. See section 9 of this Certificate.	
Regulation:	39(a)(i)	Conservation measures
Regulation:	40(2)	Target carbon dioxide Emissions Rate
Comment:	Roofs incorporating the system can satisfy or contribute to satisfying these Regulations. See sections 7.2 and 7.3 of this Certificate.	

Construction (Design and Management) Regulations 2007

Construction (Design and Management) Regulations (Northern Ireland) 2007

Information in this Certificate may assist the client, CDM co-ordinator, designer and contractors to address their obligations under these Regulations.

See sections: 1 *Description* (1.2) and 3 *Delivery and site handling* (3.5 and 3.6) of this Certificate.

Additional Information

NHBC Standards 2013

NHBC accepts the use of the Paralon Total Warm Roof System, when installed, used and maintained in accordance with this Certificate, in relation to *NHBC Standards*, Chapter 7.1 *Flat roofs and balconies*.

CE marking

The Certificate holder has taken the responsibility of CE marking the system in accordance with harmonised Standards EN 13707 : 2004 and EN 13970 : 2004. An asterisk (*) appearing in this Certificate indicates that data shown is given in the manufacturer's Declaration of Performance.

Technical Specification

1 Description

1.1 The Paralon Total Warm Roof System consists of the following waterproofing membranes, insulation boards and vapour control layer:

- Paralon ARD/HS Plus — a polyester-reinforced, polymer-modified bitumen membrane with a lower surface finish of thermofusible film and an upper surface finish of slate granules
- Paralon NT4 Plus — a polyester-reinforced, polymer-modified bitumen membrane with a lower surface finish of thermofusible film and an upper surface finish of talc or film
- Top S 3 — a polyester-reinforced, polymer-modified bitumen membrane with a lower surface finish of thermofusible film and an upper surface finish of talc or film
- Paratorch — a composite board consisting of a polyisocyanurate insulation faced with a bitumen-impregnated fibreboard, available in falls of 1:80, 1:60 and flat
- Paratherm T — a polyisocyanurate insulation board with bitumen glass-tissue facings on both sides, available in falls of 1:80, 1:60 and flat
- Vapobar 1 — a glassfibre reinforced, polymer-modified bitumen vapour control layer incorporating a layer of aluminium foil.

1.2 The membranes are supplied in rolls and are manufactured to the nominal characteristics given in Table 1.

Table 1 Nominal characteristics of membranes

Parameter (units)	Membrane			
	Paralon ARD/HS Plus	Paralon NT4 Plus	Top S 3	Vapobar 1
Standard CE marked against	EN 13707	EN13707	EN 13707	EN 13970
Thickness (mm)	4 ⁽¹⁾	4	3	2
Length (m)	8 and 10	8 and 10	10	20
Width (m)	1	1	1	1
Mass per unit area (kg·m ⁻²)	5.1	4	3	2
Roll weight (kg)	40.8 and 51	32 and 40	30	40
Tensile strength* (N per 50 mm)				
longitudinal	750	750	700	420
transverse	650	650	450	315
Elongation at break (%)				
longitudinal	50	50	40	2
transverse	50	50	45	2
Nail tear* (N)				
longitudinal	160	160	150	–
transverse	180	180	160	–
Dimensional stability (%)	≤0.5	≤0.5	≤0.25	–
Impact resistance* (mm)	1000	1000	–	–
Static indentation (kg)	20*	20*	–	10
Low temperature flexibility* (°C)	–20	–20	–10	–10
Heat resistance (°C)	130	130	120	120

(1) Excluding slate chippings.

1.3 The insulation boards are supplied to site with the nominal characteristics shown in Table 2.

Table 2 Nominal characteristics of insulation boards

Parameter (units)	Paratorch ⁽¹⁾	Paratherm T ⁽¹⁾
Length (mm)	2400, 1200 and 600	1200
Width (mm)	1200	1200
Thickness (mm)	40 to 150 in 10 mm increments	25 to 145 in 10 mm increments
Compressive strength at 10% compression (kPa)	150	150
Density (kg·m ⁻³)	32	32
Thermal conductivity (W·m ⁻¹ ·K ⁻¹)	0.026 (<80 mm) 0.025 (80 – 119 mm) 0.024 (≥120 mm)	0.026 (<80 mm) 0.025 (80 – 119 mm) 0.024 (≥120 mm)

(1) Board sizes other than those shown may be available on request.

1.4 Other items or components which may be used with the system, but which are outside the scope of this Certificate, are:

- Impertene Primer – a solvent based, bituminous primer for use on cementitious substrates, applied by either brush or roller
- Elastomul G – a water-based, solar reflective paint for use in protecting the waterproofing membranes from sunlight and other environmental factors
- various mechanical fasteners (including a countersunk plate) – for use in securing insulation boards to the substrate
- angle fillet – an insulated profile for use at upstands and kerbs above the insulation boards to aid formation of membrane edge details.

2 Manufacture

2.1 The membranes are manufactured using the same conventional continuous bitumen coating techniques as traditional bituminous felts.

2.2 As part of the assessment and ongoing surveillance of product quality, the BBA has:

- agreed with the manufacturer the quality control procedures and product testing to be undertaken
- assessed and agreed the quality control operated over batches of incoming materials
- monitored the production process and verified that it is in accordance with the documented process
- evaluated the process for management of nonconformities

- checked that equipment has been properly tested and calibrated
- undertaken to carry out the above measures on a regular basis through a surveillance process, to verify that the specifications and quality control operated by the manufacturer are being maintained.

2.3 The management system of Imper Italia SpA has been assessed and registered as meeting the requirements of BS EN ISO 9001 : 2008 by Bureau Veritas (Certificate 209130).

3 Delivery and site handling

3.1 The system membranes are delivered to site in rolls with either paper wrappers or tape bands bearing the product name and production code. The rolls are packed on pallets and shrink-wrapped in UV protective (white) polythene.

3.2 The insulation boards are delivered to site packaged in shrink-wrap plastic.

3.3 Rolls must be stored upright on a clean, level surface, away from excessive heat and kept under cover.

3.4 The insulation boards must be kept dry, on pallets, off the ground and under cover.

3.5 Impertene Primer is classified as 'flammable' and 'harmful' under *The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (CHIP4)/Classification, Labeling and Packaging of Substances and Mixtures (CLP Regulations) 2009* and all containers bear the appropriate hazard warning label.

3.6 Impertene Primer containers must be kept tightly sealed and stored under cool and dry conditions, away from sources of ignition.

Assessment and Technical Investigations

The following is a summary of the assessment and technical investigations carried out on the Paralon Total Warm Roof System.

Design Considerations

4 General

4.1 The Paralon Total Warm Roof System is suitable for use as a warm roof waterproofing system incorporating vapour control layers and thermal insulation in:

- partially or fully-adhered waterproofing specifications on flat and pitched roofs with limited access
- loose-laid and ballasted waterproofing on flat roofs with limited access
- protected roof specifications, eg covered by pavers or other suitable protection on flat roofs with limited access
- pedestrian access roofs with additional protection on flat roofs with limited access.

4.2 The granular surfaced membrane may, where appropriate, be used as an exposed cap sheet or in detail work.

4.3 Limited access roofs are defined for the purposes of this Certificate 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, such as pedestrian access roofs, additional protection must be provided (see sections 11 and 15.6 of this Certificate and the relevant clauses of the Certificate holder's installation instructions).

4.4 Pedestrian access roofs are defined for the purposes of this Certificate as those roofs not subjected to vehicular traffic.


4.5 Flat roofs are defined for the purposes of this Certificate as those roofs having a minimum finished fall of 1:80. Pitched roofs are defined for the purpose of this Certificate as those having falls greater than 1:6. When designing flat roofs, twice the minimum finished fall should be assumed, unless a detailed analysis of the roof is available including, for example, overall and local deflection and direction of falls.

4.6 Structural decks to which the system is to be applied must comply with the relevant requirements of BS 6229 : 2003, BS 8217 : 2005 and, where appropriate, *NHBC Standards 2013, Chapter 7.1 Flat roofs and balconies*.

5 Practicability of installation

The system must only be installed by contractors who have been trained and approved by the Certificate holder or their appointed agent.

6 Weathertightness

 6.1 The waterproofing membranes, including joints, when completely sealed and consolidated, will adequately resist the passage of moisture to the inside of the building and so meet the requirements of the national Building Regulations:

England and Wales — Approved Document C, Requirement C2(b), section 6

Scotland — Mandatory Standard 3.10, clauses 3.10.1 and 3.10.7

Northern Ireland — Regulation 28(b).

6.2 The membranes are impervious to water and will give a weathertight roofing capable of accepting minor structural movements without damage.

7 Thermal performance

7.1 Calculations of thermal transmittance (U value) must be carried out in accordance with BS EN ISO 6946 : 2007 and BRE Report (BR 443 : 2006) *Conventions for U-value calculations*, using the declared thermal conductivity ($\lambda_{90/90}$ value) of the insulation components as shown in Table 3.

Table 3 Thermal conductivity ($\lambda_{90/90}$ values)

Insulation thickness (mm)	Thermal conductivity ($W \cdot m^{-1} \cdot K^{-1}$)
< 80	0.026
$\geq 80 < 120$	0.025
≥ 120	0.024



7.2 The U value of a completed roof will depend on the thickness of insulation used, the number and type of fixings and the insulating value of other roof components/layers. Example U values of roofs incorporating the system are shown in Tables 4 and 5.

Table 4 Example U values — Paratherm T insulation boards

U value requirement ($W \cdot m^{-2} \cdot K^{-1}$)	Deck construction/insulation thickness (mm)		
	Concrete ⁽¹⁾⁽²⁾	Timber ⁽¹⁾⁽³⁾	Metal ⁽¹⁾⁽⁴⁾
0.13	210	200	220
0.16	170	160	175
0.18	150	140	155
0.20	130	125	140
0.25	105	100	115

(1) Includes 5.55 steel fixings per m^2 and 3.55 steel waterproofing fixings per m^2 , with a 4.8 mm cross sectional head diameter and full insulation penetration depth.

(2) Concrete decking $2.0 W \cdot m^{-1} \cdot K^{-1}$, 38 mm timber battens (15%), VCL, 7 mm waterproofing membranes, 12.5 mm plasterboard.

(3) 18 mm plywood decking, 150 mm timber joists (12.5%) with 150 mm airspace (87.5%), VCL, 7 mm waterproofing membranes, 12.5 mm plasterboard.

(4) Metal deck (not included in calculation), VCL, 7 mm waterproofing membranes.

Table 5 Example U values — Paratorch insulation boards

U value requirement ($W \cdot m^{-2} \cdot K^{-1}$)	Deck construction/insulation thickness (mm)		
	Concrete ⁽¹⁾⁽²⁾	Timber ⁽¹⁾⁽³⁾	Metal ⁽¹⁾⁽⁴⁾
0.13	215	205	225
0.16	175	165	185
0.18	155	145	160
0.20	135	130	145
0.25	110	105	120

(1) Includes 5.55 steel fixings per m^2 and 3.55 steel waterproofing fixings per m^2 , with a 4.8 mm cross sectional head diameter and full insulation penetration depth.

(2) Concrete decking $2.0 W \cdot m^{-1} \cdot K^{-1}$, 38 mm timber battens (15%), VCL, 7 mm waterproofing membranes, 12.5 mm plasterboard.

(3) 18 mm plywood decking, 150 mm timber joists (12.5%) with 150 mm airspace (87.5%), VCL, 7 mm waterproofing membranes, 12.5 mm plasterboard.

(4) Metal deck (not included in calculation), VCL, 7 mm waterproofing membranes.



7.3 The system can contribute to maintaining continuity of thermal insulation at junctions between elements and openings. For Accredited Construction Details, the corresponding psi values in BRE Information Paper IP1/06 *Assessing the effects of thermal bridging at junctions and around openings*, Table 6, may be used in carbon emission calculations in Scotland and Northern Ireland. Detailed guidance for other junctions and on limiting heat loss by air infiltration can be found in:

England and Wales — Approved Documents to Part L and for new thermal elements to existing buildings, Accredited Construction Details (version 1.0). See also SAP 2009, Appendix K, and the *iSBEM User Manual* for new-build

Scotland — Accredited Construction Details (Scotland)

Northern Ireland — Accredited Construction Details (version 1.0).

8 Condensation risk

Interstitial condensation



8.1 Roofs incorporating a VCL with a vapour resistance of at least $250 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}$ will adequately limit the risk of interstitial condensation when they are designed and constructed in accordance with BS 5250 : 2002, Section 8.4 and Appendix D, and BRE Report (BR 262 : 2002) *Thermal insulation: avoiding risks* in England and Wales.

8.2 For the purposes of assessing the risk of interstitial condensation, the vapour resistivity of the insulation boards may be taken as approximately $306 \text{ MN}\cdot\text{s}\cdot\text{g}^{-1}\cdot\text{m}^{-1}$.



8.3 Where an effective VCL cannot be guaranteed, eg due to a large number of penetrations through the layer, the risk of condensation must be assessed in accordance with BS 6229 : 2003, Annex A.

Surface condensation



8.4 Roofs will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $0.35 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point and the junctions with other elements are designed in accordance with section 7.3.



8.5 Roofs will adequately limit the risk of surface condensation when the thermal transmittance (U value) does not exceed $1.2 \text{ W}\cdot\text{m}^{-2}\cdot\text{K}^{-1}$ at any point. Guidance may be obtained from BS 5250 : 2002, Section 8 and BRE Report (BR 262 : 2002).

8.6 Alternatively, a detailed assessment in accordance with BS 5250 : 2002, Annex D, and BS EN ISO 13788 : 2002, Section 5 can be carried out to show that surface condensation and mould growth are not predicted.

9 Properties in relation to fire



9.1 When tested and classified in accordance with BS EN 13501-5 : 2005 + A1 : 2009, a system comprising:

- a 19 mm exterior plywood substrate
- a fully bonded layer of Vapobar 1
- a 40 mm thick Paratorch PIR insulation board (mechanically fastened)
- a fully bonded layer of Top S 3
- a fully bonded layer of Paralon ARD/HS Plus

achieved a $B_{\text{ROOF}}(t_4)$ rating.

9.2 Top S 3, when used in protected or loose-laid and ballasted roof specifications, including an inorganic covering listed in the Annex of Commission Decision 2000/553/EC, can be considered to be unrestricted under the national Requirements.



9.3 When used on flat roofs with one of the surface finishes defined in Part iii of Table A5 of Appendix A of The Building Regulations (England and Wales), or Technical Booklet E, Table 5.6, Part IV of The Building Regulations (Northern Ireland), and listed below, the roof is deemed to be unrestricted:

- bitumen-bedded stone chippings covering the whole surface to a depth of not less than 12.5 mm
- bitumen-bedded tiles of a non-combustible material
- sand and cement screed
- macadam.



9.4 The designation of other specifications (eg on combustible substrates) should be confirmed by:

England and Wales — test or assessment in accordance with Approved Document B, Appendix A, clause 1

Scotland — tests to confirm compliance with Mandatory Standard 2.8, clause 2.8.1

Northern Ireland — test or assessment by a UKAS-accredited laboratory, or an independent consultant with appropriate experience.

10 Resistance to wind uplift

The adhesion of the bonded membranes is sufficient to resist the effects of wind suction, elevated temperature and thermal shock conditions likely to occur in practice.

11 Resistance to foot traffic

11.1 The system can accept the limited foot traffic and light concentrated loads associated with installation and maintenance. Where traffic in excess of this is envisaged, such as maintenance of lift equipment, a walkway must be provided (for example, using concrete slabs supported on bearing pads or manufacturer's walkway sheets). Reasonable care must be taken to avoid puncture of the membranes by sharp objects or concentrated loads.

11.2 For design purposes, the insulation boards may be assumed to have an allowable compressive strength of 150 kPa at 10% compression.

11.3 The insulation boards have not been assessed for use with permanent distributed or concentrated loads, such as air conditioning units, mechanical plants, water tanks, etc. Such loads must be supported directly on the roof construction or design support system.

11.4 When profiled decking is used, boards will need to span ribs. Maximum permissible spans between ribs for various board thicknesses are shown in Table 6.

Table 6 Maximum clear span

Maximum clear span (mm)	Minimum board thickness (mm)
< 75	25
> 75 ≤ 100	30
> 100 ≤ 125	35
> 125 ≤ 150	40
> 150 ≤ 175	45
> 175 ≤ 200	50
> 200 ≤ 225	55
> 225 ≤ 250	60


12 Maintenance

 12.1 Systems must be the subject of annual inspections and maintenance to ensure continued performance. Maintenance should include checks and operations to ensure the following where applicable:

- adequate ballast is in place and evenly distributed over the membrane
- protection layers are in good condition
- exposed membrane is free from the build-up of silt, and other debris and unwanted vegetation are cleared.

12.2 Where damage has occurred it should be repaired in accordance with section 17 and the Certificate holder's instructions.

13 Durability

 13.1 Accelerated weathering tests and visits to existing 30 year old installations confirm that satisfactory retention of physical properties is achieved. Available evidence indicates that the system will have a service life in excess of 30 years.

13.2 When using Paralon ARD/HS Plus, it is possible that some localised loss of granular surfacing may occur after some years in areas where complex detailing of the roof design is incorporated.

14 Reuse and recyclability

14.1 The waterproofing membranes are made from bitumen and polyester that can be recycled.

14.2 The vapour control layers are made from bitumen, aluminium and glass that can be recycled.

Installation

15 General

15.1 Installation of the Paralon Total Warm Roof System must be carried out by installers trained and approved by the Certificate holder in accordance with the relevant clauses of BS 8000-4 : 1989, BS 8217 : 2005, the Certificate holder or appointed agent's instructions and this Certificate.

15.2 Substrates to which the system is to be applied must be sound, dry and clean, and free from sharp projections such as nail heads and concrete nibs. Wet insulation boards must not be used. For the tapered boards to be effective in providing a uniform fall, it is essential that the structural deck is true and even. Any hollows, depressions or backfalls found in the roof deck must be rectified prior to laying the insulation.

15.3 Installation must not be carried out during inclement weather (eg rain, fog or snow). When the temperature is below 5°C suitable precautions against surface condensation must be taken.

15.4 Detailing must be formed in accordance with the Certificate holder's instructions.

15.5 Soil or other bulk material must not be stored on one area of the roof prior to installation, to ensure localised overloading does not occur.

15.6 If the roof is likely to be subject to uncontrolled pedestrian access, the substructure must meet the requirements of BS 8217 : 2005, and to prevent damage to the roof covering one of the appropriate surface finishes referred to in clause 6.12 of the Standard must be used.

15.7 At falls in excess of 1:11, the provision for mechanical fixings as required by BS 8217 : 2005 should be observed.

15.8 On completion of the roof, the surface of the Paralon NT4 Plus membrane must always be protected when used as an exposed top layer.

15.9 The membranes may also have a surface finish applied in accordance with BS 8217 : 2005, clause 8.19, including:

- stone aggregate in dressing compound
- precast concrete paving slabs
- proprietary tiles on bonding compound.

15.10 The exposed surface of the membranes can be finished with a solar protective coating of Elastumul G. Such coatings must be the subject of regular checks to ensure their continued effectiveness.

15.11 Insulation boards can be cut to fit around projections through the roof, using either a sharp knife or a fine-toothed saw.

16 Procedure (Vapour control layer)

16.1 When adhering the Vapobar 1 VCL the deck must be treated with Impertene Primer beforehand.

16.2 The VCL is fully torch-bonded to the deck with side laps of 100 mm and end laps of 150 mm or loose-laid if used in conjunction with mechanically-fastened insulation.

16.3 At perimeters and penetrations the VCL is detailed to envelop the insulation boards.

17 Procedure (Insulation)

17.1 The insulation boards are installed in a close-butted break-bonded pattern.

17.2 On metal decks the boards are laid either with the long axis at right angles to the corrugations of the metal deck or diagonally across the corrugations of the deck, ensuring that all end joints and corners are sufficiently supported on the crown flats of the decking. The thickness of the board to be used is dependent on the width of the trough openings of the metal deck as indicated in Table 6 in section 11.4.

Fully bonded

17.3 The installed boards are bonded to the VCL using hot bitumen (maximum temperature 240°C) or a polyurethane adhesive.

Mechanically-fastened

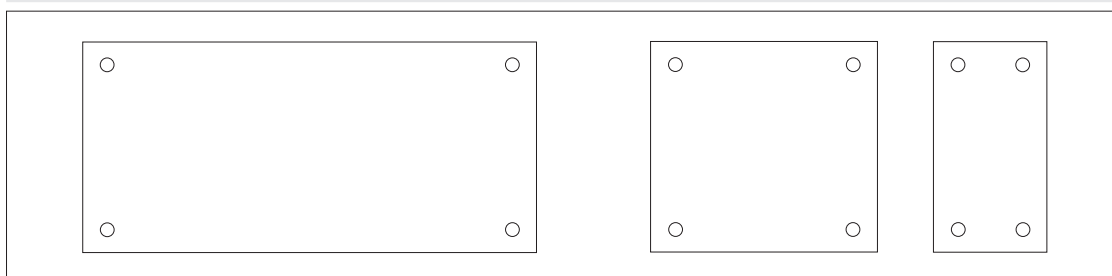
17.4 The boards are secured to the substrate by means of mechanical fastenings.

17.5 Each fixing must incorporate a minimum 50 mm by 50 mm square or 50 mm diameter circular plate countersunk washer, which must not restrain more than one board. The minimum number of fixings for each board size is given in Table 7 and fixing layouts are shown in Figure 1, with the requirement for additional fixings assessed in accordance with BS EN 1991-1-4 : 2005 and the UK National Annex. These are placed within the individual board area and sited more than 50 mm but less than 150 mm from the edges and corners of the board, giving a minimum fixing rate of 5.55 fixings per square metre for 1200 mm by 600 mm boards.

Table 7 Minimum number of fixings

Board dimensions (mm)	Minimum number of fixings
2400 x 1200	6
1200 x 1200	4
1200 x 600	4

Figure 1 Fixing layouts — minimum fixing numbers (for solely mechanically-fixed specification)



18 Procedure (membrane)

Fully bonded

18.1 Bonding is achieved by melting the lower surface by torching and pressing the membrane down. Care must be taken not to overheat the coating.

18.2 Side laps must be a minimum of 100 mm for Paralon NT and 80 mm for Paralon ARD/HS and end laps must be a minimum of 150 mm. Where used partially-bonded, the membrane must be fully bonded to the substrate at least one metre immediately before and after the end lap. A bead of molten material must extrude from all laps to indicate a satisfactory seal and must be levelled out using a heated, rounded-tip trowel.

Partially bonded

18.3 A layer of perforated felt must be loose-laid edge to edge over the substrate.

18.4 The membrane is then fully torch-welded onto the perforated layer ensuring that the bitumen seeps evenly into the perforations.

Loose-laid

18.5 Side laps must be a minimum of 100 mm and end laps must be a minimum of 150 mm. The laps must be welded by torching the lower surface and pressing the membrane down.

18.6 With loose-laid systems the membranes must be ballasted to combat the effects of wind uplift. This can be achieved by:

- laying a 0.2 mm thick polyethylene protective sheet or non-woven polyester sheet covered by at least 50 mm of well-rounded gravel (gravel size 15/30 mm)
- laying a 0.2 mm thick polyethylene or non-woven polyester sheet (minimum mass 300 g·m⁻²) covered by a 20 mm thick layer of sand overlaid with a layer of concrete paving slabs⁽¹⁾.

(1) If paving on plastic pads the sand is not required.

19 Repair

In the event of accidental damage, repairs can be carried out by cleaning the area around the damage and applying a patch as described in the Certificate holder's instructions.

Technical Investigations

20 Tests

20.1 An assessment was made of data to EN 13707 : 2004 in relation to:

- characteristics of the membranes
 - thickness
 - width
 - length
 - mass per unit area
 - watertightness*
 - tensile force*
 - elongation at break
 - static indentation (soft support)*
 - dynamic indentation (rigid support)*
 - nail tear*
 - peel resistance of joint*
 - shear resistance of joints*
 - low temperature flexibility*
 - dimensional stability
 - heat resistance
 - adhesion of granules
- characteristics of the polyester reinforcements
 - mass
 - tensile strength and elongation
- physical properties of coating mass (as used in Paralon membranes)
 - softening point on unaged and heat aged samples
 - penetration
 - fines content
 - low temperature flexibility on unaged and heat aged samples
 - heat ageing for 180 days at 70°C

- physical properties of the sheets – directional
 - tensile strength and elongation
 - dimensional stability
 - tear strength
- physical properties of the membrane
 - water absorption
 - water pressure
 - low temperature flexibility on unaged, heat aged and water soaked samples
 - heat resistance on unaged and heat aged samples
 - heat ageing for 180 days at 70°C
 - water soaking for 7 days at 60°C
- joints
 - air pressure
 - resistance to peeling on unaged and aged samples
 - tensile strength of end laps and side laps on unaged, heat aged and water soaked samples
 - heat ageing for 28 days at 80°C
 - water soaking for 7 days at 60°C
- physical properties of the system
 - static indentation on soft substrates
 - dynamic indentation on soft substrates
 - slip resistance
 - unrolling at low temperature
 - peel resistance from primed asbestos, concrete, polyurethane insulation board and other substrates on unaged and heat-aged samples
 - wind uplift of the system fully bonded to concrete, perlite insulation boards and Paratorch PIR insulation boards
 - thermal shock
 - fatigue cycling
 - heat ageing for 28 days at 70°C.

20.2 Test data on the resistance to ultraviolet light ageing were evaluated.

21 Investigations

21.1 A survey of known users of the membranes was carried out to assess performance in UK conditions.

21.2 Visits were made to existing sites in Italy and Dublin to assess the performance in use.

21.3 Data relating to the external fire performance of Paralon NT4 Plus were evaluated.

21.4 An assessment was made of the data leading to the issue of previous BBA Certificate 88/1983.

21.5 The manufacturing process, including the methods adopted for quality control, were assessed.

Bibliography

BS 5250 : 2011 *Code of practice for control of condensation in buildings*

BS 6229 : 2003 *Flat roofs with continuously supported coverings — Code of practice*

BS 8000-4 : 1989 *Workmanship on building sites — Code of practice for waterproofing*

BS 8217 : 2005 *Reinforced bitumen membranes for roofing — Code of practice*

BS 8747 : 2007 *Reinforced bitumen membranes (RBMs) for roofing — Guide to selection and specification*

BS EN 13501-5 : 2005 + Amendment 1 : 2009 *Fire classification of construction products and building elements — Classification using data from external fire exposure to roofs tests*

BS EN ISO 6946 : 2007 *Building components and building elements — Thermal resistance and thermal transmittance — Calculation method*

BS EN ISO 9001 : 2008 *Quality management systems — Requirements*

EN 13707 : 2004 *Flexible sheets for waterproofing — Reinforced bitumen sheets for roof waterproofing — Definitions and characteristics*

EN 13970 : 2004 *Flexible sheets for waterproofing — Bitumen water vapour control layers — Definitions and characteristics*

22 Conditions

22.1 This Certificate:

- relates only to the product/system that is named and described on the front page
- is issued only to the company, firm, organisation or person named on the front page — no other company, firm, organisation or person may hold or claim that this Certificate has been issued to them
- is valid only within the UK
- has to be read, considered and used as a whole document — it may be misleading and will be incomplete to be selective
- is copyright of the BBA
- is subject to English Law.

22.2 Publications, documents, specifications, legislation, regulations, standards and the like referenced in this Certificate are those that were current and/or deemed relevant by the BBA at the date of issue or reissue of this Certificate.

22.3 This Certificate will remain valid for an unlimited period provided that the product/system and its manufacture and/or fabrication, including all related and relevant parts and processes thereof:

- are maintained at or above the levels which have been assessed and found to be satisfactory by the BBA
- continue to be checked as and when deemed appropriate by the BBA under arrangements that it will determine
- are reviewed by the BBA as and when it considers appropriate.

22.4 The BBA has used due skill, care and diligence in preparing this Certificate, but no warranty is provided.

22.5 In issuing this Certificate, the BBA is not responsible and is excluded from any liability to any company, firm, organisation or person, for any matters arising directly or indirectly from:

- the presence or absence of any patent, intellectual property or similar rights subsisting in the product/system or any other product/system
- the right of the Certificate holder to manufacture, supply, install, maintain or market the product/system
- actual installations of the product/system, including their nature, design, methods, performance, workmanship and maintenance
- any works and constructions in which the product/system is installed, including their nature, design, methods, performance, workmanship and maintenance
- any loss or damage, including personal injury, howsoever caused by the product/system, including its manufacture, supply, installation, use, maintenance and removal
- any claims by the manufacturer relating to CE marking.

22.6 Any information relating to the manufacture, supply, installation, use, maintenance and removal of this product/system which is contained or referred to in this Certificate is the minimum required to be met when the product/system is manufactured, supplied, installed, used, maintained and removed. It does not purport in any way to restate the requirements of the Health and Safety at Work etc. Act 1974, or of any other statutory, common law or other duty which may exist at the date of issue or reissue of this Certificate; nor is conformity with such information to be taken as satisfying the requirements of the 1974 Act or of any statutory, common law or other duty of care.