

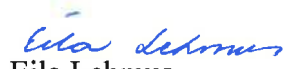




# Suitability of Kingspan wall and roof panels for different fire class buildings and applications

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<p>Summary</p> <p>This report is a corrected version which replaces the research report no. VTT-R-00640-13.</p> <p>This report includes an expert assessment of the suitability of Kingspan wall and roof panels for use in accordance with the Finnish building code sections E1 and E2 concerning P1, P2 and P3 fire class buildings with no more than 2 storeys.</p> <p>According to the available testing and classification reports Kingspan panels (KS 600 -1200 AB / CS / AWP / TL / TC / TF / RW / XD IPN with a total thickness of 40 - 250 mm for wall panels 25 - 250 mm for roof panels) comply with B-s1, d0 class requirements and can be assessed to be suitable for use in walls and roofs of production and warehouse buildings as well as in assembly and business buildings with following conditions:</p> <ul style="list-style-type: none"> <li>• Compartmentation requirements by storey, use and area of P1, P2, and P3 fire class buildings are followed (Kingspan panels can be used in walls for EI 15 - EI 60 requirement levels according to classifications of the product type)</li> <li>• Internal surfaces of Kingspan panels need to be covered with A2-s1, d0 class building materials in walls and ceilings of exits in P1 and P2 class buildings</li> <li>• Roof covering attached to Kingspan panel must meet B<sub>ROOF</sub> (t2) requirements and large roof surfaces shall be broken up in parts of not more than 2400 m<sup>2</sup>.</li> </ul>	
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## 1 Task

This report includes an expert assessment of the suitability of Kingspan wall and roof panels for use in accordance with the Finnish building code sections E1 and E2 concerning P1, P2 and P3 fire class buildings in the following applications: walls and roofs of production, warehouse, assembly and business buildings. This evaluation concerns buildings with no more than 2 storeys. Possible required protection methods of the panels are described with examples. Examined wall and roof panels are defined in section 3.1.

## 2 Source material

In this assessment the following documents have been used as source material and they are referred to in the text as [Ax].

- [A1] Reaction to fire classification report No. PK-10-050. IPN Core. Centrum stavebního inženýrství a.s. Fire Technical Laboratory. 25<sup>th</sup> June 2010. 4 p.
- [A2] WF Classification Report No. 317471. Classification of reaction to fire performance. KS1100CS. Exova Warringtonfire. 2 April 2012. 5 p.
- [A3] WF Classification Report No. 324235. Classification of reaction to fire performance. KS1100AB. Exova Warringtonfire. 22 November 2012. 5 p.
- [A4] EC Certificate of Conformity č. 1020 – CPD – 050018428. Self-supporting double skin metal faced insulating panels. Roof KS 1000 RW (th. 40-160 mm) and wall KS 1000/1150 TF (th. 40-100 mm), KS 1000 AWP (th. 50-120 mm), KS 1000 TL (th. 40-100 mm), KS 1150 TL (th. 100-200 mm); reaction to fire test – classification. Technical and Test Institute for Construction Prague. 1 p.
- [A5] Classification Report FIRES-CR-115-08-AUPE. Reaction to fire classification report for product. Wall, double skin metal faced insulating panels KS 1000 TF IPN2. 24.10.2008. 4 p. + 1 Annex.
- [A6] Classification Report FIRES-CR-116-08-AUPE. Reaction to fire classification report for product. Wall, double skin metal faced insulating panels KS 1000 SF IPN2. 24.10.2008. 4 p. + 1 Annex.
- [A7] Classification Report FIRES-CR-114-08-AUPE. Reaction to fire classification report for product. Double skin metal faced insulating panels KS 1000 RW IPN2. 24.10.2008. 4 p. + 1 Annex.
- [A8] Classification of fire resistance FIRES-CR-132-11-AURE. Non-loadbearing wall made of self-supporting double skin metal faced insulating panels KS 1000 AWP 80 IPN. 22.07.2011. 3 p.
- [A9] Fire resistance classification report No. PK2-06-11-001-A-0. Non-loadbearing wall KS1000 AWP 120 IPN Vertical. PAVUS, a.s. 2011-02-24. 4 p.
- [A10] Classification of fire resistance FIRES-ER-047-11-NURE. Wall made of double skin metal faced insulating panels “OPTIMO” IPN core. 08.12.2011. 15 p.
- [A11] WF Assessment Report No. 319872. Extended application report in accordance with EN 15254-5 and EN 14509. KS1100CS. Exova Warringtonfire. 28<sup>th</sup> June 2012. 9 p.
- [A12] Fire resistance test on a 100 mm-thick Kingspan KS1100CS partition. BRE Global. Test report number 263479. 6<sup>th</sup> August 2010. 25 p.

- [A13] Classification report No.: 2009-Efectis-R0534. Classification of fire resistance performance. Partition wall, type KS 1100 CS with a thickness of 175 mm. Efectis Nederland B.V. Centre for Fire Safety. June 2009. 5 p.
- [A14] Fire resistance classification report No. PK2-06-09-004-A-0. External non-loadbearing wall KS1000 TL 100 IPN Horizont. PAVUS, a.s. 2009-07-10. 4 p.
- [A15] Fire resistance classification report No. PK2-06-09-005-A-0. External non-loadbearing wall KS1000 TL 100 IPN Vertical. PAVUS, a.s. 2009-09-03. 4 p.
- [A16] Fire resistance classification report No. PK2-06-10-002-A-0. Non-loadbearing wall KS1150 TC 200 IPN Vertical. PAVUS, a.s. 2010-06-01. 4 p.
- [A17] Classification of fire resistance FIRES-CR-042-09-AUPE. Roof made of sandwich panels KS 1000 RW 80, 80 mm thick (IPN core). 29.5.2009. 4 p.
- [A18] Classification of fire resistance FIRES-CR-132-10-AUPE. Roof made of sandwich panels KS 1000 XD 80, 80 mm thick with IPN core. 17.09.2010. 4 p.
- [A19] Fire resistance classification report No. PK2-03-09-001-A-0. Kingspan KS1000 XD 100 mm Roof Sandwich Panel. PAVUS, a.s. 2009-01-29. 4 p.
- [A20] E1 Suomen rakentamismääräyskokoelma. Rakennusten paloturvallisuus. Määräykset ja ohjeet 2011. Helsinki. Ympäristöministeriö, Rakennetun ympäristön osasto. (E1 The national building code of Finland. Fire safety of buildings.) 43 p.
- [A21] E2 Suomen rakentamismääräyskokoelma. Tuotanto- ja varastorakennusten paloturvallisuus. Ohjeet 2005. Helsinki. Ympäristöministeriö, Asunto- ja rakennusosasto (E2 The national building code of Finland. Fire safety of production and warehouse buildings). 8 p + App. 1 p.
- [A22] Fire test of facade cladding. PX17250. SP Technical Research Institute of Sweden. 2012-05-08. 6 p. + App. 21 p.

### 3 Assessment of fire performance

#### 3.1 Product specifications and fire classifications

This assessment concerns Kingspan wall and roof panels, which consist of IPN Fire Safe (PIR /polyisocyanurate) core and the inner and outer surfaces made of coated steel sheet (thicknesses: the inner surface 0.4 - 1.1 mm, the outer surface 0.5 - 0.7 mm). The thickness of the panels varies between 25 - 250 mm and the width between 600 - 1200 mm. The product information and fire classifications provided by the manufacturer are used as the basis of the assessment and the following Kingspan panels are considered:

Wall panels:

- KS 600-1200 AB/CS: Thickness at least 80 mm (according to the manufacturer AB and CS are the same product with different trade names)
- KS 1000 AWP (earlier SF): Thickness at least 50 mm
- KS 1150 TL/TC: Thickness at least 100 mm (according to the manufacturer TL and TC are the same product with different trade names)
- KS 1150 TF: Thickness at least 40 mm

Roof panels:

- KS 1000 RW: Thickness at least 25 mm
- KS 1000 XD: Thickness at least 80 mm.

According to document [A1] the IPN polyurethane insulation (thickness  $\geq 80$  mm) fulfils the requirements of reaction to fire class D-s1, d0. According to documents [A2, A3, A4, A5, A6] the Kingspan wall panels with IPN core comply with the class B-s1, d0 requirements when the total thickness of the panels is at least 40 mm, and the roof panels comply with the class B-s1, d0 requirements when the total thickness of the panels is at least 25 mm [A7].

For non-load bearing Kingspan wall panels the following fire separating classifications are available:

- KS 1000 AWP 80 IPN [A8]:
  - o EI 15: Thickness at least 80 mm, mounted horizontally with maximum span of 12.0 m and mounted vertically with maximum span of 4.0 m
- KS 1000 AWP 120 IPN Vertical [A9]:
  - o EI 20: Thickness at least 120 mm, maximum span 4.0 m
- KS 1000 AWP OPTIMO [A10]:
  - o EI 15: Thickness at least 60 mm, maximum span 3.0 m; thickness at least 120 mm, mounted horizontally with maximum span of 12.0 m and mounted vertically with maximum span of 4.0 m
  - o EI 20: paksuus vähintään 120 mm, jänneväli korkeintaan 3.0 m
- KS1100 CS:
  - o EI 30: Thickness at least 150 mm, mounted horizontally with maximum span of 11.0 m [A11]; thickness at least 100 mm, mounted horizontally with maximum span of 3.0 m [A12]
  - o EI 60: Thickness at least 175 mm, mounted vertically with maximum span of 4.0 m [A13]
- KS1150 TL/TC:
  - o EI 30: Thickness at least 100 mm, mounted horizontally with maximum span of 4.0 m and mounted vertically with maximum span of 3.0 m [A14, A15]
  - o EI 60: Thickness at least 200 mm, mounted vertically with maximum span of 4.0 m [A16].

Kingspan roof panels comply with class REI 30 requirements as follows:

- KS 1000 RW panel up to span of 4.5 m when the thickness of the panel is at least 80 mm [A17]
- KS 1000 XD panel up to span of 2.12 m when the thickness of the panel is at least 80 mm [A18] and up to span of 6.00 m when the thickness of the panel is at least 100 mm [A19].

Testing of fire separating function of the Kingspan panels have been made with the panel widths of 1000 - 1100 mm. Thus, the results are valid up to the width of 1200 mm according to the standard EN 14509.

## 3.2 Applications

Examined types of buildings in P1, P2 and P3 fire class have maximum 2 storeys and the uses are limited to the following applications: walls and roofs in production and warehouse buildings as well as in assembly and business buildings.

According to the Finnish building code part E1 [A20], assembly and business premises are divided into three categories: 1) fire load under  $600 \text{ MJ/m}^2$  and area

$\leq 300 \text{ m}^2$ , 2) fire load under  $600 \text{ MJ/m}^2$  and area over  $300 \text{ m}^2$ , and 3) fire load  $\geq 600 \text{ MJ/m}^2$ . Production and warehouse premises belong to either fire hazard class 1 or fire hazard class 2. According to the Finnish building code part E2 [A21], production and storage operations associated with a minor or moderate fire hazard belong to fire hazard class 1, and operations associated with a considerable or large-scale fire hazard or where an explosion hazard may be present belong to fire hazard class 2.

### 3.3 Suitability of Kingspan wall and roof panels for different applications

The suitability of Kingspan wall and roof panels for applications defined in section 3.2 in P1, P2 and P3 class buildings are shown in Tables 1 – 6. Concerning class P1, only buildings with maximum of 2 storeys are reviewed. Class P2 and P3 production and warehouse facilities as well as assembly and business premises may not exceed 2 storeys.

For a P1 class building, the requirement for building materials used in external wall is the following [A20]:

8.3.1 *Building materials used in external walls in buildings of class P1 shall be mainly of at least class B-s1, d0.*

**Guideline:** *Thermal insulation which is inferior to class B-s1, d0 shall be protected and positioned in such a manner that the spread of fire into the insulation, from one fire compartment to another and from one building to another building is prevented. In these cases rendering or a metal sheet is generally not a sufficient protection.*

There are generally no compartmentation requirements for external walls and roofs. Compartmentation requirements by storey, use and area are given in documents [A20, A21] and the compartmentation by area in production and warehouse buildings requires the use of A1 class building materials. When considering the results of Tables 1-6 it should be noted that additional requirements (e.g. for compartmentation) may follow, depending on other possible solutions or uses directly related to the structures or in their vicinity.

The suitability of Kingspan panels for use in external walls and roofs are shown in Tables 1 – 6 for maximum 2 storey P1, P2 and P3 class buildings when the use categories are production and warehouse facilities as well as assembly and business facilities.

#### 3.3.1 P1 class buildings

In P1 class buildings insulation of external walls, which is not at least B-s1, d0 class, must be protected so that the insulation does not contribute to spread of fire (Tables 1 and 2). Concerning external fires this condition can be found to be satisfied based on the large scale (height 6 m and width 4 m) SP 105 Fire test [A22].

According to documents [A2, A4, A5, A6] Kingspan panel meets the B-s1, d0 class requirements and in the classification test total the heat release produced during 10 minutes ( $\text{THR}_{600\text{s}}$ ) is 1.6 - 3.1 MJ. According to document [A1] the corresponding value for the IPN polyurethane insulation (without steel sheet surfaces) is 5.0 MJ. Because in A2 and B classes the highest allowed value for  $\text{THR}_{600\text{s}}$  is 7.5 MJ, the contribution to fire of Kingspan panel with IPN insulation

can be considered to be very limited. Thus, Kingspan panel including thermal insulation does not spread fire more than an external wall made of building materials complying with B-s1, d0 requirements.

According to documents [A8, A10, A12, A13, A14, A15, A16], Kingspan wall panel meets the requirements of EI 15 (thickness at least 60 - 80 mm), EI 30 (thickness at least 100 mm) or EI 60 class (thickness at least 175 mm / 200 mm), and Kingspan roof panel (thickness at least 80 mm) meets the EI 30 class requirements [A17, A18, A19]. Based on these compartmentation classifications it can be concluded that Kingspan panel does not spread fire beyond the fire compartment during the time indicated by the fire rating for the minimum thicknesses in question.

Table 1. P1 class, maximum 2 storey building, production and warehouse facilities

		Requirement	Kingspan panel
<b>Walls</b>	Internal surfaces <i>Fire hazard class 1</i> <i>Fire hazard class 2</i>	D-s2, d2 <sup>1</sup> B-s1, d0 <sup>1</sup>	B-s1, d0 B-s1, d0
	External surfaces	B-s1, d0	B-s1, d0
	Insulation in external wall	B-s1, d0 or sufficiently protected	Outside: Does not spread fire (SP Fire 105) Inside: Does not spread fire (EI 15 - EI 60)
	Compartmentation/extern. wall Compartmentation by storey & use Compartmentation by area	Generally no requirement At least EI 60 At least EI-M 60/A1	EI 15 – EI 60
<b>Roofs</b>	Internal surfaces <i>Fire hazard class 1</i> <i>Fire hazard class 2</i>	D-s2, d2 <sup>1</sup> B-s1, d0 <sup>1</sup>	B-s1, d0 B-s1, d0
	Top surface of uppermost floor (when a cavity between roof element and roof covering)	B-s1, d0	B-s1, d0
	Relaxation of R requirement for roofs when insulation is not at least A2-s1, d0 class	Internal side K <sub>2</sub> 60 or EI 60 protected <sup>2</sup>	Insulation D-s1, d0 Protection with e.g. 2 x 18 mm F type gypsum boards
	Compartmentation	Generally no requirement	EI 30
	Roof coverings	B <sub>ROOF</sub> (t2)	Approved roofing <sup>3</sup>

<sup>1</sup> Requirement for walls and ceilings of exits is A2-s1, d0

<sup>2</sup> If there is no attic and the insulation of roof belonging to classes F – B is protected from ignition, charring and other damage at least for 60 minutes, requirement for structures, which are the primary part of load-bearing framework or bracing of the building, is 60 minutes in all fire load categories. Otherwise, the requirement in fire load category under 600 MJ/m<sup>2</sup> is R 60, in fire load category 600 - 1200 MJ/m<sup>2</sup> R 90 and in fire load category over 1200 MJ/m<sup>2</sup> R 120, where R<sub>xx</sub> means that the load-bearing structures must be made of at least class A2-s1, d0 building materials. In addition, structures which are a secondary part of the load-bearing framework or bracing of the building can be a qualified for class R15.

<sup>3</sup> Roof covering must be classified on a substrate which covers the properties of Kingspan panels and large roof surfaces shall be broken up in parts of not more than 2400 m<sup>2</sup>.



According to Tables 1 and 2, Kingspan panel surfaces in walls and ceilings of exits need to be covered with A2-s1, d0 class building materials in P1 class production and warehouse buildings as well as in assembly and business buildings with no more than 2 storeys.

Table 2. P1 class, maximum 2 storey building, assembly and business spaces

		Requirement	Kingspan panel
Walls	Internal surfaces <i>Fire load &lt; 600 MJ/m<sup>2</sup></i> - area ≤ 300 m <sup>2</sup> - area > 300 m <sup>2</sup> <i>Fire load ≥ 600 MJ/m<sup>2</sup></i>	D-s2, d2 <sup>1</sup> C-s2, d1 <sup>1</sup> B-s1, d0 <sup>1</sup>	B-s1, d0 B-s1, d0 B-s1, d0
	External surfaces	B-s1, d0	B-s1, d0
	Insulation in external wall	B-s1, d0 or sufficiently protected	Outside: Does not spread fire (SP Fire 105) Inside: Does not spread fire (EI 15 - EI 60)
	Compartmentation/extern. wall Compartmentation by storey, use and area	Generally no requirement At least EI 60	EI 15 – EI 60
Roofs	Internal surfaces <i>Fire load &lt; 600 MJ/m<sup>2</sup></i> - area ≤ 300 m <sup>2</sup> - area > 300 m <sup>2</sup> <i>Fire load ≥ 600 MJ/m<sup>2</sup></i>	D-s2, d2 <sup>1</sup> C-s2, d1 <sup>1</sup> B-s1, d0 <sup>1</sup>	B-s1, d0 B-s1, d0 B-s1, d0
	Top surface of uppermost floor (when a cavity between roof element and roof covering)	B-s1, d0	B-s1, d0
	Relaxation of R requirement for roofs when insulation is not at least A2-s1, d0 class	Internal side K <sub>2</sub> 60 or EI 60 protected <sup>2</sup>	Insulation D-s1, d0 Protection with e.g. 2 x 18 mm F type gypsum boards
	Compartmentation	Generally no requirement	EI 30
	Roof coverings	B <sub>ROOF</sub> (t2)	Approved roofing <sup>3</sup>

<sup>1</sup> Requirement for walls and ceilings of exits is A2-s1, d0

<sup>2</sup> If there is no attic and the insulation of roof belonging to classes F – B is protected from ignition, charring and other damage at least for 60 minutes, requirement for structures, which are the primary part of load-bearing framework or bracing of the building, is 60 minutes in all fire load categories. Otherwise, the requirement in fire load category under 600 MJ/m<sup>2</sup> is  $\boxed{R\ 60}$ , in fire load category 600 - 1200 MJ/m<sup>2</sup>  $\boxed{R\ 90}$  and in fire load category over 1200 MJ/m<sup>2</sup>  $\boxed{R\ 120}$ , where  $\boxed{R_{xx}}$  means that the load-bearing structures must be made of at least class A2-s1, d0 building materials. In addition, structures which are a secondary part of the load-bearing framework or bracing of the building can be a qualified for class R15.

<sup>3</sup> Roof covering must be classified on a substrate which covers the properties of Kingspan panels and large roof surfaces shall be broken up in parts of not more than 2400 m<sup>2</sup>.

### 3.3.2 P2 class buildings

In P2 production and warehouse buildings fire separating structures for area based compartmentation must be made of A1 class building materials (Table 3). Thus, Kingspan panels are not suitable for this purpose.

According to Tables 3 and 4, Kingspan panel surfaces in walls and ceilings of exits need to be covered with A2-s1, d0 class building materials in P2 class production and warehouse buildings as well as in assembly and business buildings with no more than 2 storeys.

Table 3. P2 class building, production and warehouse facilities

		<b>Requirement</b>	<b>Kingspan panel</b>
<b>Walls</b>	Coverings – internal surfaces	No requirement - $K_2 10^1$	B-s1, d0
	Internal surfaces <i>Fire hazard class 1</i>	D-s2, d2 <sup>2</sup>	B-s1, d0
	<i>Fire hazard class 2</i>	B-s1, d0 <sup>2</sup>	B-s1, d0
	External surfaces	D-s2, d2	B-s1, d0
	Insulation in external wall	No requirement	D-s1, d0
	Compartmentation/extern. wall Compartmentation by storey & use Compartmentation by area	Generally no requirement At least EI 30 At least EI-M 60/A1	EI 15 – EI 60
<b>Roofs</b>	Coverings – internal surfaces	No requirement - $K_2 10^1$	B-s1, d0
	Internal surfaces <i>Fire hazard class 1</i>	B-s1, d0 <sup>2</sup>	B-s1, d0
	<i>Fire hazard class 2</i>	B-s1, d0 <sup>2</sup>	B-s1, d0
	Top surface of uppermost floor (when a cavity between roof element and roof covering)	B-s1, d0	B-s1, d0
	Use of R15 requirement for roofs when insulation is not at least A2-s1, d0 class	Internal side $K_2 30$ or EI 30 protected <sup>3</sup>	Insulation D-s1, d0 Protection e.g. 2 x 12,5 mm gypsum boards
	Compartmentation	Generally no requirement	EI 30
Roof coverings	$B_{ROOF}(t2)$	Approved roofing <sup>4</sup>	

<sup>1</sup> Requirement of coverings does not concern at least B-s1, d0 class building materials

<sup>2</sup> Requirement for walls and ceilings of exits is A2-s1, d0

<sup>3</sup> If there is no attic and the insulation of roof belonging to classes F – B is protected from ignition, charring and other damage at least for 30 minutes, the requirement is R15 for structures which are a secondary part of the load-bearing framework or bracing of the building.

<sup>4</sup> Roof covering must be classified on a substrate which covers the properties of Kingspan panels and large roof surfaces shall be broken up in parts of not more than 2400 m<sup>2</sup>.

Table 4. P2 class building, assembly and business spaces

		<b>Requirement</b>	<b>Kingspan panel</b>
<b>Walls</b>	Coverings – internal surfaces	No requirement - $K_210^1$	B-s1, d0
	Internal surfaces <i>Fire load &lt; 600 MJ/m<sup>2</sup></i> - area ≤ 300 m <sup>2</sup> - area > 300 m <sup>2</sup> <i>Fire load ≥ 600 MJ/m<sup>2</sup></i>	D-s2, d2 <sup>2</sup> C-s2, d1 <sup>2</sup> B-s1, d0 <sup>2</sup>	B-s1, d0 B-s1, d0 B-s1, d0
	External surfaces	D-s2, d2	B-s1, d0
	Insulation in external wall	No requirement	D-s1, d0
	Compartmentation/external wall Compartmentation by storey, use and area	Generally no requirement At least EI 30	EI 15 – EI 60
	<b>Roofs</b>	Coverings – internal surfaces	No requirement - $K_210^1$
Internal surfaces <i>Fire load &lt; 600 MJ/m<sup>2</sup></i> - area ≤ 300 m <sup>2</sup> - area > 300 m <sup>2</sup> <i>Fire load ≥ 600 MJ/m<sup>2</sup></i>		D-s2, d2 <sup>2</sup> C-s2, d1 <sup>2</sup> B-s1, d0 <sup>2</sup>	B-s1, d0 B-s1, d0 B-s1, d0
Top surface of uppermost floor (when a cavity between roof element and roof covering)		B-s1, d0	B-s1, d0
Use of R15 requirement for roofs when insulation is not at least A2-s1, d0 class		Internal side $K_2 30$ or EI 30 protected <sup>3</sup>	Insulation D-s1, d0 Protection e.g. 2 x 12,5 mm gypsum boards
Compartmentation		Generally no requirement	EI 30
Roof coverings		$B_{ROOF}(t_2)$	Approved roofing <sup>4</sup>

<sup>1</sup> Requirement of coverings does not concern at least B-s1, d0 class building materials

<sup>2</sup> Requirement for walls and ceilings of exits is A2-s1, d0

<sup>3</sup> If there is no attic and the insulation of roof belonging to classes F – B is protected from ignition, charring and other damage at least for 30 minutes, the requirement is R15 for structures which are a secondary part of the load-bearing framework or bracing of the building.

<sup>4</sup> Roof covering must be classified on a substrate which covers the properties of Kingspan panels and large roof surfaces shall be broken up in parts of not more than 2400 m<sup>2</sup>.

### 3.3.3 P3 class buildings

For P3 buildings, the requirements are somewhat less stringent than for P1 and P2 class buildings, and they are shown in Tables 5 and 6.

In P3 production and warehouse buildings, fire separating structures for area based compartmentation must be made of A1 class building materials (Table 5). Thus, Kingspan panels are not suitable for this purpose.

Table 5. P3 class building, production and warehouse facilities

		Requirement	Kingspan panel
Walls	Internal surfaces <i>Fire hazard class 1</i> <i>Fire hazard class 2</i>	D-s2, d2 <sup>1</sup> B-s1, d0	B-s1, d0 B-s1, d0
	External surfaces	D-s2, d2	B-s1, d0
	Insulation in external wall	No requirement	D-s1, d0
	Compartmentation/extern. wall Compartmentation by storey & use Compartmentation by area	Generally no requirement EI 30 At least EI-M 60/A1	EI 15 – EI 60
	Roofs	Internal surfaces <i>Fire hazard class 1</i> <i>Fire hazard class 2</i>	D-s2, d2 <sup>1</sup> B-s1, d0
Top surface of uppermost floor (when a cavity between roof element and roof covering)		No requirement	B-s1, d0
Compartmentation		Generally no requirement	EI 30
Roof coverings		B <sub>ROOF</sub> (t2)	Approved roofing <sup>2</sup>

<sup>1</sup> Requirement for walls and ceilings of exits is B-s1, d0

<sup>2</sup> Roof covering must be classified on a substrate which covers the properties of Kingspan panels and large roof surfaces shall be broken up in parts of not more than 2400 m<sup>2</sup>.

Table 6. P3 class building, assembly and business spaces

		Requirement	Kingspan panel
Walls	Internal surfaces <i>Fire load &lt; 600 MJ/m<sup>2</sup></i> - area ≤ 300 m <sup>2</sup> - area > 300 m <sup>2</sup> <i>Fire load ≥ 600 MJ/m<sup>2</sup></i>	D-s2, d2 <sup>1</sup> D-s2, d2 <sup>1</sup> B-s1, d0	B-s1, d0 B-s1, d0 B-s1, d0
	External surfaces	D-s2, d2	B-s1, d0
	Insulation in external wall	No requirement	
	Compartmentation/external wall Compartmentation by storey, use and area	Generally no requirement EI 30	EI 15 – EI 60
	Roofs	Internal surfaces <i>Fire load &lt; 600 MJ/m<sup>2</sup></i> - area ≤ 300 m <sup>2</sup> - area > 300 m <sup>2</sup> <i>Fire load ≥ 600 MJ/m<sup>2</sup></i>	D-s2, d2 <sup>1</sup> D-s2, d2 <sup>1</sup> B-s1, d0
Top surface of uppermost floor (when a cavity between roof element and roof covering)		No requirement	B-s1, d0
Compartmentation		Generally no requirement	EI 30
Roof coverings		B <sub>ROOF</sub> (t2)	Approved roofing <sup>2</sup>

<sup>1</sup> Requirement for walls and ceilings of exits is B-s1, d0

<sup>2</sup> Roof covering must be classified on a substrate which covers the properties of Kingspan panels and large roof surfaces shall be broken up in parts of not more than 2400 m<sup>2</sup>.

## 4 Summary

According to Tables 1 – 6 presented in section 3.3, Kingspan panels (KS 600 - 1200 AB / CS / AWP / TL / TC / TF / RW / XD IPN with a total thickness of 40 - 250 mm for wall panels 25 - 250 mm for roof panels and which comply with B-s1, d0 class requirements) are suitable for use in walls and roofs of up to 2 storey P1, P2 and P3 class production and warehouse buildings as well as in assembly and business buildings with following conditions:

- Compartmentation requirements by storey, use and area of P1, P2, and P3 fire class buildings are followed (Kingspan panels can be used in walls for EI 15 - EI 60 requirement levels according to classifications of the product type)
- Internal surfaces of Kingspan panels need to be covered with A2-s1, d0 class building materials in walls and ceilings of exits in P1 and P2 class buildings
- Roof covering attached to Kingspan panel must meet B<sub>ROOF</sub> (t2) requirements and large roof surfaces shall be broken up in parts of not more than 2400 m<sup>2</sup>.