



European Technical Assessment

ETA 18/0691
of 12.12.2022



General part

Technical Assessment Body issuing the ETA: ITeC

ITeC has been designated according to Article 29 of Regulation (EU) No 305/2011 and is member of EOTA (European Organisation for Technical Assessment).

Trade name of the construction product

Ultimate Protect Slab 4.0
Ultimate Protect Slab 4.0 Alu 1

Product family to which the construction product belongs

Fire protective products.

Manufacturer

SAINT-GOBAIN ISOVER G+H AG
Bürgermeister-Grünzweig-Straße 1
D-67059 Ludwigshafen
Germany

Manufacturing plant(s)

According to Annex N kept by ITeC.

This European Technical Assessment contains

17 pages including 2 annexes which form an integral part of this assessment

and

Annex N, which contains confidential information and is not included in the European Technical Assessment when that assessment is publicly available.

This European Technical Assessment is issued in accordance with Regulation (EU) 305/2011, on the basis of

European Assessment Document EAD 350142-00-1106.

This version replaces

ETA 18/0691 issued on 19.03.2020.

General comments

Translations of this European Technical Assessment in other languages shall fully correspond to the original issued document.

Communication of this European Technical Assessment, including transmission by electronic means, shall be in full (excepted the confidential Annex(es)).

Specific parts of the European Technical Assessment

1 Technical description of the product

Ultimate Protect Slab 4.0 is a fire protective slab made of mineral wool¹ impregnated with a synthetic binder. Ultimate Protect Slab 4.0 Alu 1 is the faced product version with a reinforced aluminium foil of 66 g/m². Both Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1 are CE marked according to EN 14303².

Table 1: Dimensions and density Ultimate Protect Slab 4.0 & Alu 1.

Characteristic	Nominal value	Tolerance
Density (kg/m ³) at 23°C, 50% RH	66	± 10 %
Length (mm)	1200	± 2 %
Width (mm)	600	± 1,5 %
Thickness (mm)	50, 90	-2/+5

Assembled systems require additional products for their installation, as described in the annexes of this ETA. These products are not covered by this ETA and cannot be CE marked on its basis, as well as the installed system as a whole.

2 Specification of the intended use(s) in accordance with the applicable EAD

Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1 are intended for the fire protection of ventilation rectangular steel ducts and multi-compartment smoke extraction rectangular steel ducts, i.e. category according to section 1.2.2 of EAD 350142-00-1106:

- Type 9: Fire protective products that contribute to the fire resistance of technical services assemblies in buildings.

The environmental use conditions assessed correspond to the following use category according to section 1.2.3 of EAD 350142-00-1106:

- Type Z₂: Internal conditions excluding temperatures below 0°C, with humidity below 85% RH.

The provisions made in this ETA are based on a working life of the product of at least 25 years, provided that the conditions laid down in the manufacturer's instructions for the installation, use and maintenance are met. These provisions are based upon the current state of the art and the available knowledge and experience.

¹ Manufactured fibres of Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1 are certified by EUCB in conformity with the Note Q of Regulation (EC) No 1272/2008.

² EN 14303 Thermal insulation products for building equipment and industrial installations. Factory made mineral wool (MW) products. Specification.

The indications given as to the working life cannot be interpreted as a guarantee given by the manufacturer or Assessment Body but are to be regarded only as a means for choosing the appropriate product(s) in relation to the expected economically reasonable working life of the works.

3 Performance of the product and reference to the methods used for its assessment

3.1 Performance of the product

The assessment of Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1 has been performed in accordance with EAD 350142-00-1106 *Fire protective board, slab and mat products and kits (September 2017)*.

Table 2: Performance of the product.

Product: Ultimate Protect Slab 4.0 Ultimate Protect Slab 4.0 Alu 1		Intended use: Fire protective product
Basic requirement	Essential characteristic	Performance
	Reaction to fire	A1
BWR 2 Safety in case of fire	Resistance to fire	Ventilation (50 mm) EI 30 (ve-ho i ↔ o)
		(90 mm) EI 120 (ve-ho i ↔ o)
	Smoke extraction (90 mm) EI 120 (ve-ho) S 500 multi	
	Durability	Type Z ₂
BWR 6 Energy economy and heat retention	Thermal conductivity, $\lambda_{10, dry}$	0,031 W/(m·K)

The rest of characteristics included in EAD 350142-00-1106 have not been assessed in this ETA.

3.2 Methods used for the assessment

3.2.1 Reaction to fire

The performance of Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1 has been tested according to EN ISO 1182³ and EN ISO 1716⁴. Classification is given in accordance with EN 13501-1⁵ and Regulation (EU) 2016/364.

³ EN ISO 1182 Reaction to fire tests for products. Non-combustibility test.

⁴ EN ISO 1716 Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value).

⁵ EN 13501-1 Fire classification of construction products and building elements. Part 1: Classification using data from reaction to fire tests.

3.2.2 Resistance to fire

The fire resistance performance has been determined following the test and assessment methods given in Annex A for ventilation ducts and Annex B for multi-compartment smoke extraction ducts.

3.2.3 Durability

The durability of Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1 has been assessed for Type Z₂ conditions in accordance with section 2.2.2.3 of EAD 350142-00-1106 and EN 14303.

3.2.4 Thermal conductivity

The thermal conductivity of Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1 has been tested in accordance with EN 12667 ⁶.

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

According to the Decision 1999/454/EC of the European Commission, the system of AVCP (see EC delegated Regulation (EU) No 568/2014 amending Annex V to Regulation (EU) 305/2011) given in the following table applies.

Table 3: AVCP System.

Product(s)	Intended use(s)	Level(s) or class(es)	System(s)
Fire protective products	For fire compartmentation and/or fire protection or fire performance	Any	1

⁶ EN 12667 Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance.

5 Technical details necessary for the implementation of the AVCP system, as foreseen in the applicable EAD

All the necessary technical details for the implementation of the AVCP system are laid down in the Control Plan deposited with the ITeC and agreed in accordance with EAD 350142-00-1106, section 3.

The Control Plan is a confidential part of the ETA and only handed over to the notified product certification body involved in the assessment and verification of constancy of performance.

The factory production control operated by the manufacturer shall be in accordance with the above-mentioned Control Plan.

Issued in Barcelona on 12 December 2022
by the Catalonia Institute of Construction Technology.



Ferran Bermejo Nualart
Technical Director, ITeC

ANNEX A. Specification and assessment of ventilation rectangular ducts fire protected with Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1

A.1 Horizontal ventilation duct

A.1.1 Resistance to fire performance

The ventilation duct assembly has been tested and assessed according to EN 1366-1⁷ and has a resistance to fire performance of:

- EI 30 (ho i ↔ o) with 50 mm slabs.
- EI 120 (ho i ↔ o) with 90 mm slabs.

A.1.2 Installation requirements

The provisions given in this ETA, which are based on the tests performed, should be followed. However, the range of installed systems will vary depending on the design of the ventilation ductwork and, therefore, the system installation should be carried out in accordance with the manufacturer's instructions.

A.1.2.1 Duct

Rectangular steel duct made from folded 0,7 mm thickness sheets, with maximum dimensions of the internal duct section of 1250 mm x 1000 mm (width x height), and the characteristics given in the next table.

Table A.1.1: Rectangular steel duct specification.

Case	Duct tightness class	Segment length	Stiffeners
EI 30 with 50 mm slabs	Class C or better according to EN 1507 ⁸	1500 mm	Not required
EI 120 with 90 mm slabs	Class B or better according to EN 1507	1250 mm	1 internal stiffener per duct segment positioned at midpoint as shown in figure A.1.1. The stiffeners are steel threaded rods of diameter 8 mm, placed inside a steel pipe with outer diameter 16 mm and thickness 2 mm. The steel rods are fixed to the duct using 4 washers of external diameter 70 mm and thickness 1 mm, inside and outside the duct, and M8 nuts.

The joints between duct segments consist of steel flanges Lindab type RJFP 30 of dimensions 30,0 mm x 30,0 mm x 1,2 mm, or equivalent, as shown in figure A.1.2. The flanges are fixed to the duct using spot welding and clamped together with bolt clamps from Lindab type LSMS 30 at a maximum distance of 250 mm along the duct width (at least 4) and 125 mm along the duct height (at least 2).

⁷ EN 1366-1 Fire resistance tests for service installation. Part 1: Ducts.

⁸ EN 1507 Ventilation for buildings. Sheet metal air ducts with rectangular section. Requirements for strength and leakage.

Ceramic tape type of 3 mm x 20 mm is installed between the flanges. In the corners, the flanges are fitted with corner profiles and bolted together.



Fig. A.1.1: Duct internal stiffeners (EI 120).

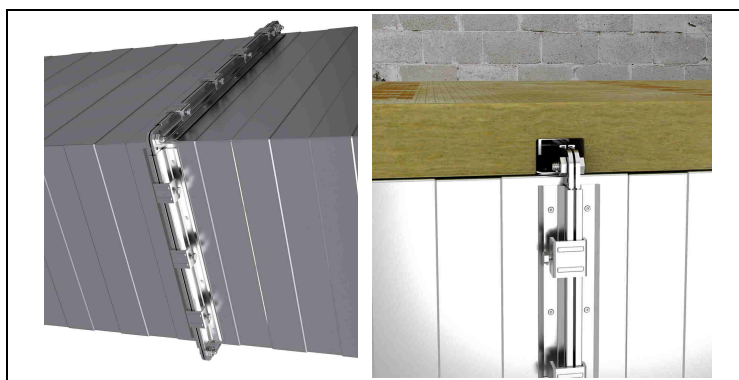


Fig. A.1.2: Example of joints between duct segments.

Duct side branches, T-pieces or direction changing pieces can be installed according to the manufacturer's instructions.

The duct is assessed to work at a pressure difference as shown in the next table.

Table A.1.2: Pressure difference.

Case	Pressure difference
Ventilation duct EI 30 with 50 mm slabs	– 500 Pa to + 500 Pa
Ventilation duct EI 120 with 90 mm slabs	– 300 Pa to + 300 Pa

A.1.2.2 Duct suspension elements

The steel duct suspension elements will be designed and positioned in accordance with section 13.6.1 of EN 1366-1 and section 9.2.2 of EN 15882-1 to limit the maximum stresses in the rods and fixings to the values given in Table 7 of EN 1366-1.

As a tested reference, shown in figure A.1.3, the main characteristics of the suspension elements are given in the next table.

Table A.1.3: Tested suspension elements description for reference.

	Duct EI 30 with 50 mm slabs	Duct EI 120 with 90 mm slabs
Maximum stress of steel rods in cold conditions	6 MPa	3 MPa
Maximum distance from the rods to the duct vertical side	50 mm	10 mm
Largest distance between suspension elements	1800 mm	1330 mm
Position of the suspension elements	Approximately 50 mm from the duct joints and 170 mm from the insulation joints	

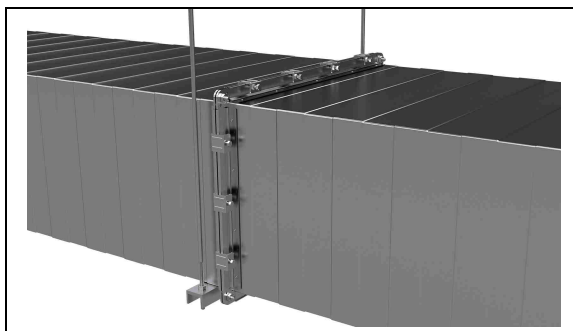


Fig. A.1.3: Example of duct suspension elements.

A.1.2.3 Fire protective insulation

The duct is clad with Ultimate Protect Slab 4.0 or Ultimate Protect Slab 4.0 Alu 1, according to section 1 of this ETA, positioned with staggered joints and fixed using steel welding pins of diameter 2,7 mm and nominal length 52 mm (for 50 mm slabs) or 93 mm (for 90 mm slabs), and 30 mm washers. The maximum distance between pins is 260 mm, and of the pins to the duct edges or slab joints is 80 mm. The slabs on the upper side of the duct are installed without pins. An example of slabs and pins installation at the down side is shown in figure A.1.4. In the case of Ultimate Protect Slab 4.0 Alu 1, all joints between slabs are finished with Protect Black Tape.

Fire Protect Screws from Isover G+H of length 100 mm (for 50 mm slabs) or 180 mm (for 90 mm slabs) are used as fixing between slabs at maximum distance of 260 mm, as shown in figure A.1.5 (through the side slabs into the upper and down side slabs).

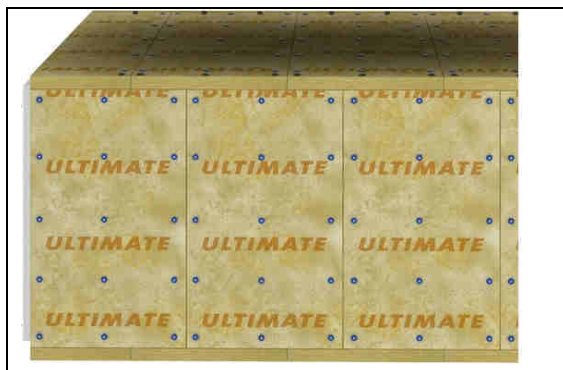


Fig. A.1.4: Ultimate Protect Slab 4.0 installation (duct down side).



Fig. A.1.5: Fire Protect Screws for slabs fixing.

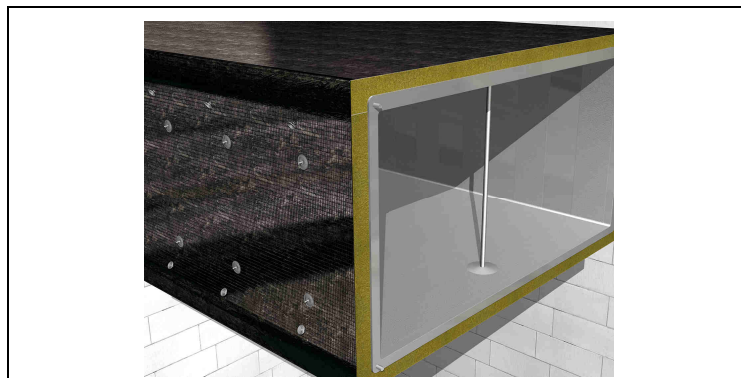


Fig. A.1.6: Example of Ultimate Protect Slab 4.0 Alu 1 installation.

A.1.2.4 Supporting construction

The wall through which the duct passes is described in the next table.

Table A.1.4: Wall characteristics.

Case	Type	Minimum thickness	Minimum resistance to fire
Ventilation duct EI 30 with 50 mm slabs	Flexible or rigid wall	70 mm	EI 30
Ventilation duct EI 120 with 90 mm slabs	Rigid wall with minimum density of 650 kg/m ³	150 mm	EI 120

A.1.2.5 Wall penetration seal

The penetration seal is shown in figure A.1.7.

The gap between the steel duct and the supporting construction is 50 mm maximum.

The duct is fixed at both sides of the penetration to the supporting construction with steel L-profiles (30 mm x 30 mm x 3 mm and length according to the duct dimensions) along the longest sides (for a ventilation duct EI 30 with 50 mm slabs) or along the top, bottom and sides (for a ventilation duct EI 120 with 90 mm slabs). The duct is riveted to the horizontal and vertical L-profiles with steel rivets of diameter 3,2 mm and length 10 mm every 100 mm. The horizontal L-profiles are fixed to the supporting construction using mechanical fixings as given in the next table.

Table A.1.5: Mechanical fixing of L-profile to the wall.

Case	Fixing means
Ventilation duct EI 30 with 50 mm slabs	4 wall anchors M6 x 52 mm
Ventilation duct EI 120 with 90 mm slabs	2 steel screws of diameter 7,5 mm and length 62 mm in each end of the profile

The gap between the steel duct and the supporting construction is fitted with compressed Ultimate Protect Slab 4.0. In the case of a ventilation duct EI 120 with 90 mm slabs, the insulation is coated at both sides of the penetration with intumescent paint Protect BSF from Isover G+H, applied at an approximate dry film thickness of 2 mm.

At both sides of the penetration, the duct fire protective insulation Ultimate Protect Slab 4.0 or Ultimate Protect Slab 4.0 Alu 1 is glued to the penetration surface using silicate glue Protect BSK from Isover G+H, applied at an approximate rate of 0,66 g/cm².

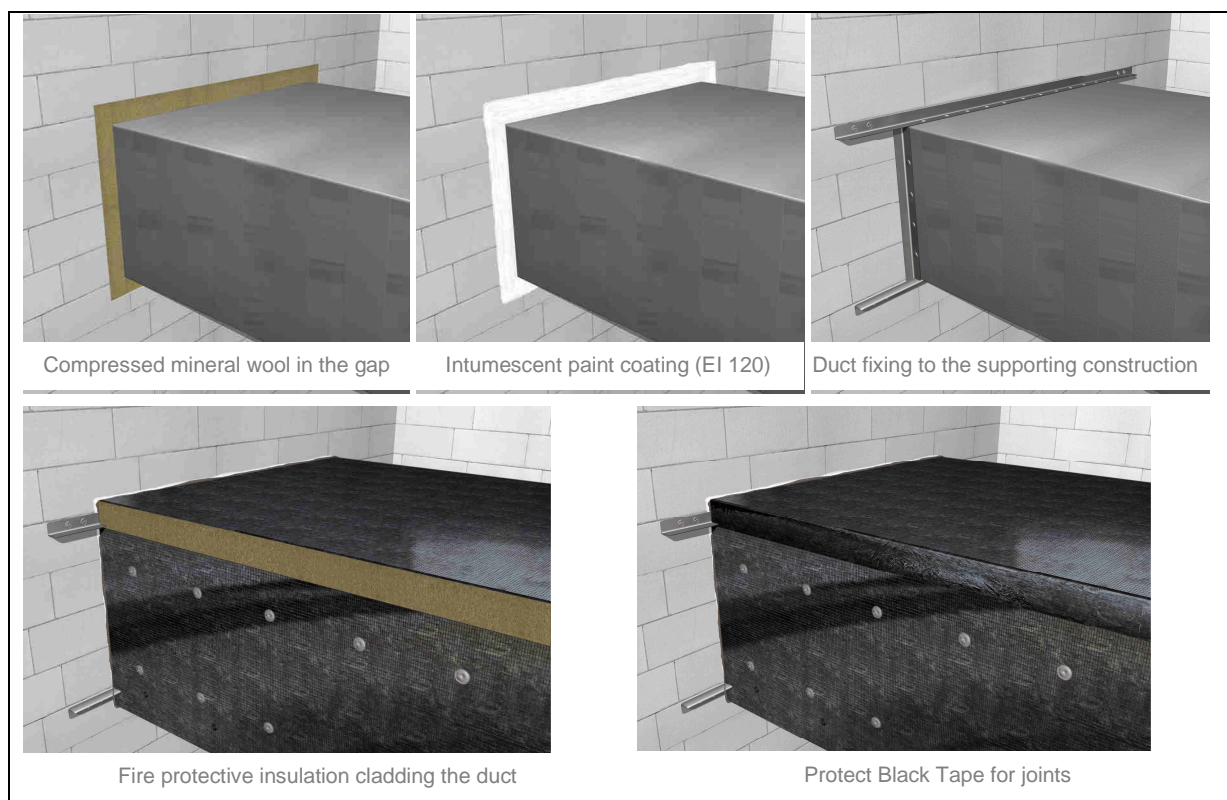


Fig. A.1.7: Example of wall penetration seal.

A.2 Vertical ventilation duct

A.2.1 Resistance to fire performance

The ventilation duct assembly has been tested and assessed according to EN 1366-1 and has a resistance to fire performance of:

- EI 30 (ve i ↔ o) with 50 mm slabs.
- EI 120 (ve i ↔ o) with 90 mm slabs.

A.2.2 Installation requirements

The provisions given in this ETA, which are based on the tests performed, should be followed. However, the range of installed systems will vary depending on the design of the ventilation ductwork and, therefore, the system installation should be carried out in accordance with the manufacturer's instructions.

A.2.2.1 Duct

Rectangular steel duct made from folded 0,7 mm thickness sheets, with maximum dimensions of the internal duct section of 1250 mm x 1000 mm (width x height), and the characteristics given in the next table.

Table A.2.1: Rectangular steel duct specification.

Case	Duct tightness class	Segment length	Stiffeners
EI 30 with 50 mm slabs	Class C or better according to EN 1507	1500 mm	Not required
EI 120 with 90 mm slabs	Class B or better according to EN 1507	1250 mm	1 internal stiffener per duct segment positioned at midpoint as shown in figure A.2.1. The stiffeners are steel threaded rods of diameter 10 mm, fixed to the duct using 4 washers of external diameter 70 mm and thickness 1 mm, inside and outside the duct, and M10 nuts.

The joints between duct segments consist of steel flanges Lindab type RJFP 30 of dimensions 30,0 mm x 30,0 mm x 1,2 mm, or equivalent, as shown in figure A.2.2. The flanges are fixed to the duct using spot welding and clamped together with bolt clamps from Lindab type LSMS 30 at a maximum distance of 250 mm along the duct width (at least 4) and 125 mm along the duct height (at least 2). Ceramic tape of 3 mm x 20 mm is installed between the flanges. In the corners, the flanges are fitted with corner profiles and bolted together.



Fig. A.2.1: Duct internal stiffeners (EI 120).

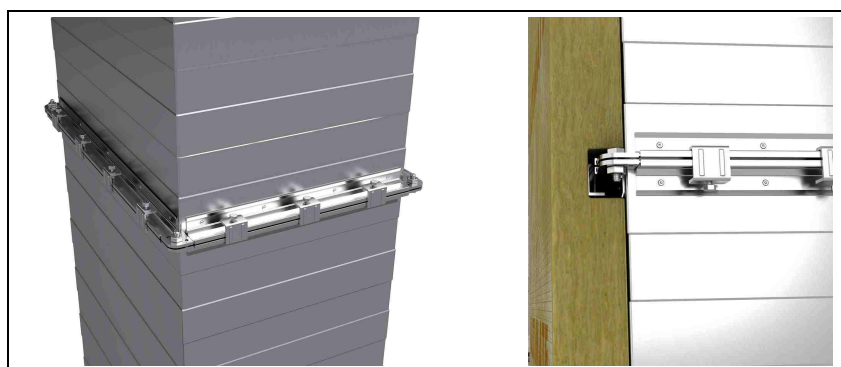


Fig. A.2.2: Example of joints between duct segments.

Duct side branches, T-pieces or direction changing pieces can be installed according to the manufacturer's instructions.

The duct can pass through any number of storeys provided that the distance between floors, where the duct is supported (see section A.2.2.4), does not exceed 5 m and the limitation on buckling is satisfied. To prevent damage to the construction from buckling of vertical ducts, the ratio between the length (height) of the duct fire exposed in the compartment to the smallest lateral dimension across the outside face of the duct does not exceed 8:1, unless additional lateral supports are provided. If additional supports are provided, the ratio of the distance between the additional supports, or the distance between the supports and the supporting construction, to the smallest lateral dimension across the outside face of the duct shall not exceed 8:1.

The duct is assessed to work at a pressure difference as shown in the next table.

Table A.2.2: Pressure difference.

Case	Pressure difference
Ventilation duct EI 30 with 50 mm slabs	- 500 Pa to + 500 Pa
Ventilation duct EI 120 with 90 mm slabs	- 500 Pa to + 500 Pa

A.2.2.2 Fire protective insulation

The duct is clad with Ultimate Protect Slab 4.0 or Ultimate Protect Slab 4.0 Alu 1, according to section 1 of this ETA, positioned with staggered joints and fixed using steel welding pins of diameter 2,7 mm and nominal length 52 mm (for 50 mm slabs) or 93 mm (for 90 mm slabs), and 30 mm washers. The maximum distance between pins is 260 mm, and of the pins to the duct edges or slab joints is 80 mm. An example of slabs and pins installation is shown in figure A.2.3. In the case of Ultimate Protect Slab 4.0 Alu 1, all joints between slabs are finished with Protect Black Tape.

Fire Protect Screws from Isover G+H of length 100 mm (for 50 mm slabs) or 180 mm (for 90 mm slabs) are used as fixing between slabs at maximum distance of 260 mm, as shown in figure A.2.4 (through the long side slabs into the short side slabs).

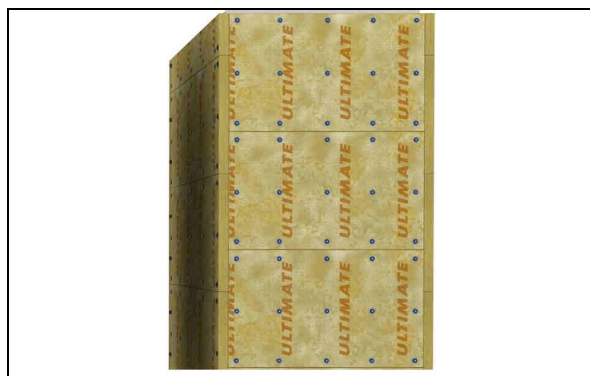


Fig. A.2.3: Ultimate Protect Slab 4.0 installation.



Fig. A.2.4: Fire Protect Screws for slabs fixing.

A.2.2.3 Supporting construction

The floor through which the duct passes is made of aerated concrete (or other type of rigid floor) with minimum density of 650 kg/m³ and the characteristics as given in the next table.

Table A.2.3: Rigid floor characteristics.

Case	Minimum thickness	Minimum resistance to fire
Ventilation duct EI 30 with 50 mm slabs	100 mm	EI 30
Ventilation duct EI 120 with 90 mm slabs	150 mm	EI 120

A.2.2.4 Floor penetration seal

The penetration seal is shown in figure A.2.5.

The gap between the steel duct and the supporting construction is 50 mm maximum.

The duct is fixed at both sides of the penetration to the supporting construction (only fixed at the top side of the penetration in the case of ducts EI 30 with 50 mm slabs) with steel L-profiles (30 mm x 30 mm x 3 mm and length according to the duct dimensions). The duct is riveted to the L-profiles with steel rivets of diameter 3,2 mm and length 10 mm every 100 mm. The long L-profiles are fixed to the supporting construction using in each end of the profile 2 steel screws of diameter 7,5 mm and length 62 mm.

The gap between the steel duct and the supporting construction is fitted with compressed Ultimate Protect Slab 4.0. In the case of a ventilation duct EI 120 with 90 mm slabs, the insulation is coated at both sides of the penetration with intumescent paint Protect BSF from Isover G+H, applied at an approximate dry film thickness of 2 mm.

At both sides of the penetration, the duct fire protective insulation Ultimate Protect Slab 4.0 or Ultimate Protect Slab 4.0 Alu 1 is glued to the penetration surface using silicate glue Protect BSK from Isover G+H, applied at an approximate rate of 0,66 g/cm².

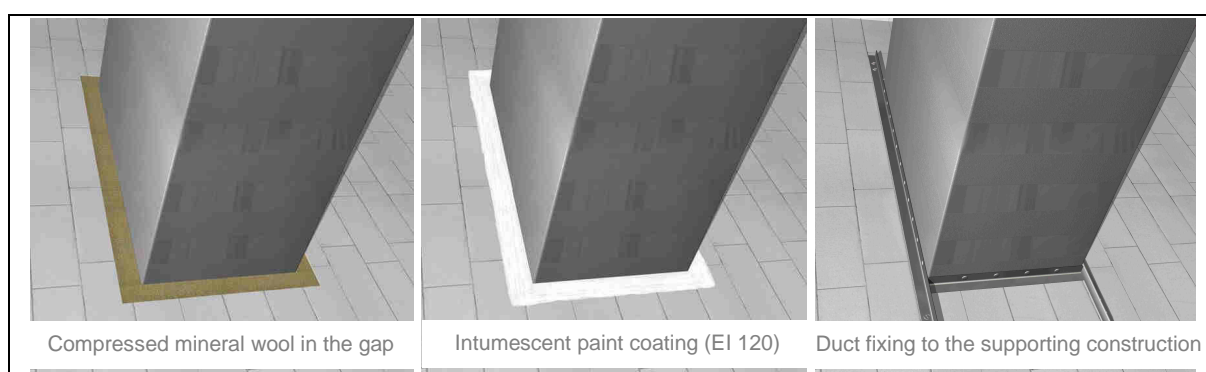


Fig. A.2.5: Example of floor penetration seal.

ANNEX B. Specification and assessment of multi-compartment smoke extraction rectangular ducts fire protected with Ultimate Protect Slab 4.0 and Ultimate Protect Slab 4.0 Alu 1 of 90 mm thickness

B.1 Resistance to fire performance

The multi-compartment smoke extraction duct assembly has been tested and assessed according to EN 1366-8⁹ and has a resistance to fire performance of EI 120 (ve-ho) S 500 multi, using 90 mm slabs.

B.2 Installation requirements

The provisions given in this ETA, which are based on the tests performed, should be followed. However, the range of installed systems will vary depending on the design of the smoke extraction ductwork and, therefore, the system installation should be carried out in accordance with the manufacturer's instructions.

B.2.1 Duct

Rectangular steel duct of tightness class B or better, according to EN 1507, made from folded 1,0 mm thickness sheets. The maximum dimensions of internal duct section are 1250 mm x 1000 mm (width x height for horizontal ducts) and the segment length 1500 mm.

Each duct segment has 5 internal stiffeners evenly distributed as shown in figure B.1. The stiffeners are steel threaded rods of diameter 8 mm, placed inside a steel pipe with outer diameter 17,5 mm and thickness 2,35 mm. The steel rods are fixed to the duct using 4 washers of external diameter 70 mm and thickness 1 mm, inside and outside the duct, and M8 nuts.

The joints between duct segments consist of steel flanges Lindab type RJFP 30 of dimensions 30,0 mm x 30,0 mm x 1,2 mm, or equivalent, as shown in figure B.2. The flanges are fixed to the duct using spot welding and held together with a C-profile from Lindab type RJFP 20. Joint bolt clamps Lindab type RJCL 30 are mounted (with a M10 mm bolt) on the C-profiles every 265 mm at the long duct sides and 110 mm at the short duct sides. Ceramic tape type of 3 mm x 20 mm is installed between the flanges. In the corners, the flanges are fitted with corner profiles and bolted together.

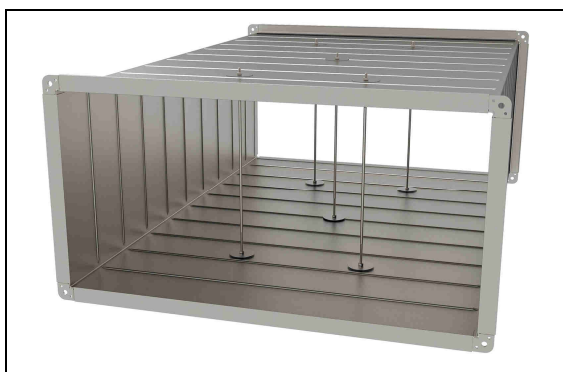


Fig. B.1: Duct internal stiffeners.



Fig. B.2: Joints between duct segments.

⁹ EN 1366-8 Fire resistance tests for service installation. Part 8: Smoke extraction ducts. Assessment of the reduction in the duct cross-section has been carried out according to section 9.5 of prEN 1366-8 version February 2017.

Duct side branches, T-pieces or direction changing pieces can be installed according to the manufacturer's instructions.

In the case of vertical ducts, the duct can pass through any number of storeys provided that the distance between floors, where the duct is supported (see section B.2.5), does not exceed 5 m and the limitation on buckling is satisfied. To prevent damage to the construction from buckling of vertical ducts, the ratio between the length (height) of the duct fire exposed in the compartment to the smallest lateral dimension across the outside face of the duct does not exceed 8:1, unless additional lateral supports are provided. If additional supports are provided, the ratio of the distance between the additional supports, or the distance between the supports and the supporting construction, to the smallest lateral dimension across the outside face of the duct shall not exceed 8:1.

The duct is assessed to work at a pressure difference between – 500 Pa to + 500 Pa.

B.2.2 Duct suspension elements for horizontal ducts

The steel duct suspension elements will be designed and positioned in accordance with section 13.6.1 of EN 1366-1 and section 9.2.2 of EN 15882-1 to limit the maximum stresses in the rods and fixings to the values given in Table 7 of EN 1366-1.

As a tested reference, shown in figure B.3, the duct is suspended with hangers consisting of steel rod at maximum stress of 4 MPa. The distance from the rods to the vertical side of the duct is 10 mm approximately. The largest distance between suspension elements is 1530 mm. The hangers and support profile are positioned at approximately 50 mm from the duct joints.

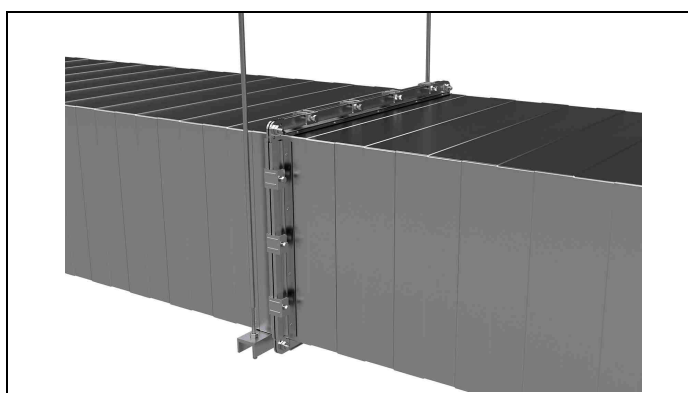


Fig. B.3: Horizontal duct suspension elements.

B.2.3 Fire protective insulation

The duct is clad with Ultimate Protect Slab 4.0 or Ultimate Protect Slab 4.0 Alu 1 of 90 mm thickness, according to section 1 of this ETA, positioned with staggered joints and fixed using steel welding pins of diameter 2,7 mm and nominal length 93 mm, and 30 mm washers. The maximum distance between pins is 260 mm. The distance of the pins to the duct edges or slab joints is 80 mm. In the case of horizontal ducts, the slabs on the upper side of the duct are installed without pins. Examples of slabs and pins installation are shown in figure A.1.4 for horizontal ducts and A.2.3 for vertical ducts.

Fire Protect Screws from Isover G+H of length 180 mm are used as fixing between slabs at maximum distance of 260 mm, as shown in figure A.1.5 for horizontal ducts and A.2.4 for vertical ducts.

In the case of Ultimate Protect Slab 4.0 Alu 1, all joints between slabs are finished with Protect Black Tape.

B.2.4 Supporting construction

B.2.4.1 Walls passed by horizontal ducts

The wall through which the duct passes is made of aerated concrete (or other type of rigid wall) with a minimum thickness of 150 mm and a minimum density of 650 kg/m³.

B.2.4.2 Floors passed by vertical ducts

The floor through which the duct passes is made of aerated concrete (or other type of rigid floor) with minimum density of 650 kg/m³ and minimum thickness of 150 mm.

B.2.5 Penetration seal

The penetration seal is shown in figure A.1.7 for horizontal ducts and A.2.5 for vertical ducts.

The gap between the steel duct and the supporting construction is 50 mm maximum.

The duct is fixed at both sides of the penetration to the supporting construction with steel L-profiles (30 mm x 30 mm x 3 mm and length according to the duct dimensions) along the duct sides. The duct is riveted to the L-profiles with steel rivets of diameter 3,2 mm and length 10 mm every 100 mm. The long L-profiles are fixed to the supporting construction using in each end of the profile 2 steel screws of diameter 7,5 mm and length 62 mm.

The gap between the steel duct and the supporting construction is fitted with compressed Ultimate Protect Slab 4.0. The insulation is coated at both sides of the penetration with intumescent paint Protect BSF from Isover G+H, applied at an approximate dry film thickness of 2 mm.

At both sides of the penetration, the duct fire protective insulation Ultimate Protect Slab 4.0 or Ultimate Protect Slab 4.0 Alu 1 is glued to the penetration surface using silicate glue Protect BSK from Isover G+H, applied at an approximate rate of 0,66 g/cm².