MARCH 2014

Strong Defense Against Fire

FirePro®

VENTILATION AND SMOKE EXTRACT DUCTS

Solutions & Technical Manual

SOBEN INTERNATIONAL

High Performance Building Boards & Solutions for Sustainable Construction

FP®-900/FirePro®
Fire Rated Ventilation Steel Ducts
FPD60/120/180/240

SOBEN BOARD INTERNATIONAL

PRODUCT DESCRIPTION

FP®-900/FirePro® is an eco-friendly high performance autoclaved calcium silicate board in compliance with the stringent criteria for third party certification green label product scheme. It does not contain any harmful substances or inorganic fibres and is free from formaldehyde and toxic emissions. It is robust and lightweight for use in fire resisting dry construction. The superior non-flammable nature of FP®-900/FirePro® is conformed to non-combustible when tested in accordance with EN 13501-1: Class A1, BS 476: Part 4 and AS 1530.1. As revealed from fire tests, FP®-900/FirePro® is capable of resisting fire attack up to 1200°C for 240 minutes when exposed to the heating condition of EN 1363-1. Please consult Soben International for technical information and details of local equivalence.

FP®-900/FirePro® is off-white in colour and has a smooth sanded surface on one side and a slightly textured reverse. It is made of fire resistant minerals and calcium silicate matrix reinforced with selected cellulose fibres and special fillers. The board has undergone a sophisticated process and then cured under an autoclaving process where high pressure and high temperature steam is induced to ensure its intrinsic fire resistant property and excellent dimensional stability, wherever FP®-900/FirePro® is exposed to fire or humid environments.

Apart from the fire resistant property, FP®-900/FirePro® is also an ideal building board for use in construction where there is a need for resistance to damp or high humidity. It contains no water soluble additives and will not rot, degrade or deteriorate. Fibre-reinforced calcium silicate matrix will absorb water causing some loss of strength, which is fully recovered on drying. Any staining on the board caused by leakage can be easily painted over. Moisture will not cause leaching or efflorescence and has no permanent effect on FP®-900/FirePro®. It is simple to work with and easy to decorate. FP®-900/FirePro® is manufactured to Quality Management System Certification ISO 9001, Environmental Management System Certification ISO 14001, Hong Kong Green Label as well as Singapore Green Label.

APPLICATIONS FOR CONSTRUCTION

FP®-900/FirePro® passive fire protection systems are extensively tested and technically assessed by international accredited fire test consulting engineers. Typical applications include:

- Walls and hoardings
- Ceilings, roofs and floors
- Fire rated doors
- Shaft walls for lift or building services
- Electrical & mechanical services enclosures
- Fire resistant barriers and spandrels
- Ventilation, smoke outlet and Kitchen extract ducts
- Fire resistance upgrade of concrete and tunnel fire protection

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TECHNICAL PERFORMANCE

FirePro®/FP®-900 is EN 13501-1: Class A1 non-combustible calcium silicate board. It has superior fire resistance performance and excellent dimensional stability under heat or severe moisture environments.

TEST	STANDARD	RESULT	
Density		900 kg/m^3 +/-10%	
Nominal weight		8.9kg/m^2 - 9 mm 11.9kg/m^2 -12mm 13.8kg/m^2 -14mm 14.8kg/m^2 -15mm 17.8kg/m^2 -18mm 23.7kg/m^2 -24mm	
Size		1220 x 2440mm 1200 x 2400mm	
Surface alkalinity		pH 7-10	
Flexural strength		6.0 N/mm^2	transverse
		9.5 N/mm^2	longitudinal
Minimum bending radius		7200mm - 9mm 9800mm - 12mm	longitudinal
Moisture movement	ambient to saturated	0.05%	
Dimensional changes in length due to relative humidity	BS EN 318	+0.01% @20°C, RH 30%~85% - 0.02% @20°C, RH 85%~30%	
Moisture content		Ex works - 15% In situ - 6%	
Thermal conductivity	EN 12264	0.17 W/mK	
Linear thermal expansion	BS EN ISO 10515-8	-3.06 x 1E^{-6}/°C	
Fire rated systems	BS 476: Part 20-24 BS EN1364-1 & 2	up to 240 minutes	
Non-combustible	AS 1530.1 BS 476: Part 4 BS EN ISO 1182	Pass	
Heat of combustion	BS EN ISO 1716	Pass	
Reaction to Fire - Classification	EN 13501-1	Euro Class A1	
Surface spread of flame	BS 476: Part 7	Class 1	
Fire propagation	BS 476: Part 6	Class 0	
Ignitability	BS 476: Part 5	Class P	
Acoustic reduction (over range 100-3150 Hz)	AS 1276.1 & 1191 ASTM E90 & E413 EN ISO 10140-3 & 717-1	STC/Rw (dB)	steel framed partition
		26	9mm
		46	99mm
		49	105mm
Green labeled building board	HKGLS SGLS	no heavy metal & no harmful substance Singapore Environmental Council Hong Kong Green Council	
Organic emission	ASTM D5116-06	Non toxic & No formaldehyde, satisfied the emission tests	
Recyclable product	ISO 14001	Crushed down for recycle use, Products made under ISO 14001 environmental management system	

Note: All physical performance values of products depicted in this technical handbook are averages based on the standard production. The figures may be changed dependent on the test method used.

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FP®-900/FIREPRO® FIRE RESISTANT VENTILATION STEEL DUCTS

The prevention of fire spread through ducted systems is of critical importance, fire is contained in a compartment as first and foremost in stopping the spread of fire in a building. In particular, passive fire protection is an effective measure to defense fire attack and uphold fire safety of the building. As a leading manufacturer of high performance fire resistant calcium silicate boards in Asia, Soben International manipulates advanced technologies and dedicated engineers in designing a range of sophisticated FP®-900/FirePro® ventilation steel ducts among other fire barriers and offering passive fire solutions to meet the building regulations.

FIRE TESTING METHOD

A method for determination of the fire resistance of ventilation ducts BS 476: Part 24 -1987 (ISO 6944) specifies the criteria for fire testing and procedures for ventilation duct, smoke outlet and kitchen extract ducts. These involve a Duct B test – spread of fire through the ventilation duct inside from one compartment to another; and a Duct A test – fire attacks the duct outside only. The document includes an explanatory Annex giving guidance on the fire performance criteria required for kitchen extract and smoke outlet applications, which differ from the requirements for ventilation ducts. It is important that the evaluation and suitability of any proposed system of fire resisting ductwork matches the requirements for the application; (e.g. a smoke outlet duct to maintain a minimum 75% of the original cross section when tested to BS 476: Part 24).

The size of ventilation duct 1000mm x 250mm was specified in the standard fire test, In practice, the use of large sized ducts in commercial buildings are commonly required. To ensure the stability of the large sized duct, a full technical assessment on the duct systems with respect to various applications should be conducted by an accredited fire testing consultant, as specified in BS 9999 –Ref 7.2.

FIRE RESISTANCE

The ability of a building element or a construction to satisfy, for a stated period of time, the appropriate criteria specified in BS 476: Part 20 and the following criteria are applied to fire resistant ductworks.

Stability: The ability of a duct, ductwork and the support system to remain intact and fulfill their intended function for a specified period of time, when tested to the requirements of BS 476: Part 24 (ISO 6944).

Integrity: The ability of a duct or ductwork to remain free of cracks, holes or openings outside the compartment in which the fire is present for a specified period of time, when tested to the requirements of BS 476: Part 24 (ISO 6944).

Insulation: The ability of a duct or ductwork to maintain its integrity without developing temperatures on its external surface, outside the compartment in which the fire is present, which exceed:

- 140°C as an average value above ambient and/or
- 180°C as a maximum value above ambient at any one point,

when tested for a specified period of time to the requirements of BS 476: Part 24. (ISO 6944). For kitchen extract ductwork (duct A) these limitations also apply to the internal surface of the duct within the compartment in which the fire is present.

OTHER REQUIREMENTS

In additional to the standard fire tests and relevant assessments for the duct assembly, other criteria for quality certification to the duct or application pre-approval of government may be required in some countries since recent years. These ensure the duct designed, manufactured, installed strictly adhere to the specifications and designated fire safety functions for buildings.

- The duct is supplied and manufactured within a Quality Management System certified to ISO 9001: 2008.
- The duct is manufactured within a Factory Production Control (FPC), tested and assessed to a third party certification scheme
- The fire resistant duct is required to submit for an approval of local government in some countries.
- Materials of the duct assembly are manufactured within an Environmental Management System certified to ISO 14001: 2004 and a third party certification scheme for green labeling products.

The high performance FP®-900/FirePro® fire resistant ventilation steel duct and FP®-900/FirePro® fire barriers are made to the stringent criteria of the above-mentioned and have gained an approval of local government. Please contact Soben International for further information.

CONSIDERATIONS FOR FP®-900/FIREPRO® DUCT ASSEMBLY

FirePro®/FP®-900 is EN 13501-1: Class A1 non-combustible calcium silicate board. It has superior fire resistance performance and excellent dimensional stability under heat or severe moisture environments.

Supporting Construction

FP®-900/FirePro®steel duct assembly shall be supported from appropriate masonry, concrete or steel construction that has a fire resistance not less than that required for the duct assembly and be able to support the assembly for the required period of fire resistance.

Steel Duct Assembly

The steel duct must be constructed with rolled steel angle flanged or equivalent roll formed steel sheet profile cross-joints. It is recommended that longitudinal seams formed using Pittsburgh Lock or Grooved Corner Seam Systems. The duct is constructed with minimum 0.6mm thick galvanised steel sheet. General guidance on the construction of steel ductwork is given in DW/144 "Specification for sheet metal ductwork - low, medium and high pressure/ velocity air system" or equivalent specification.

Hanger Support

FP®-900/FirePro® steel duct assembly is supported by a pair of threaded drop rods and an angle or a channel bearer under the steel duct. The spacing of the hangers and the size of steel hanger components must be adjusted so that the tensile stress in the rods does not exceed the stress to respective fire ratings. The fixings used to fasten the threaded rod hangers to concrete soffits must be all-steel expanding anchors with a penetration in the concrete of minimum depth to respective fire ratings.

Fire rating- minutes	Stress limit- N/mm²	Minimum depth of anchor - mm
60	15	40
120	10	50
180	8	60
240	6	60

Penetrations Through Walls & Floor Slabs

The duct assembly passing through wall or floor slab constructions where there are weak points of fire resistance. Gaps around FP®-900/FirePro® duct and the construction at penetrations should be fully stuffed with stone wool and be sealed according to the specification.

Insulation

The stone wool insulation must be non-combustible to BS 476: Part 4 or equivalent; e.g. European Classification A1 of EN 13501-1

One, Two and Three Sided Ducts

A one, two or three sided FP®-900/FirePro® steel duct can be constructed using the appropriate adjacent concrete/masonry walls and floor slab to support the assembly. The steel duct and hanger supports are the same as for the four-sided duct assembly. The steel channel collars around one, two or three sides of the steel duct, in a similar way to the four-sided duct system, except that the ends of the channels are fixed to the angles anchored to the wall or floor elements.

Vertical Ducts

The construction of vertical ducts is the same as for the horizontal ducts.

Two Tier Ducts

This system is for two tier adjacent steel ducts that have the same width, the protection system is installed around the ducts in the same way as for the four-sided duct system except that the channel collars are fitted around the outside of the group of ducts rather than around the individual ducts.

Multiple Side By Side Ducts

This system is for two or three adjacent steel ducts, independently supported, that have the same height. The protection system is installed around the ducts in the same way as for the four-sided duct system except that the channel collars are fitted around the outside of the group of ducts rather than around the individual ducts.

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FIRE RATING

FRL	Up to 240/240/240
Standard	BS 476: Part 24-1987
	ISO 6944-1985
Approval	Exova 336212
	Fires FR-114-13-AUNE
	Fires FR-114-13-AUNE

ACOUSTIC

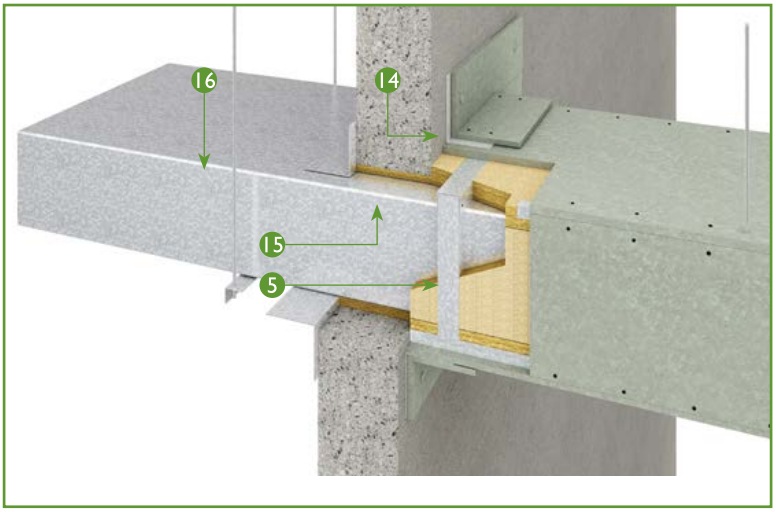
STC / Rw *	23dB up
Standard	EN ISO 10140-2:2010
	EN ISO 717-1: 2013
Assessment	Marshall Day - INSUL

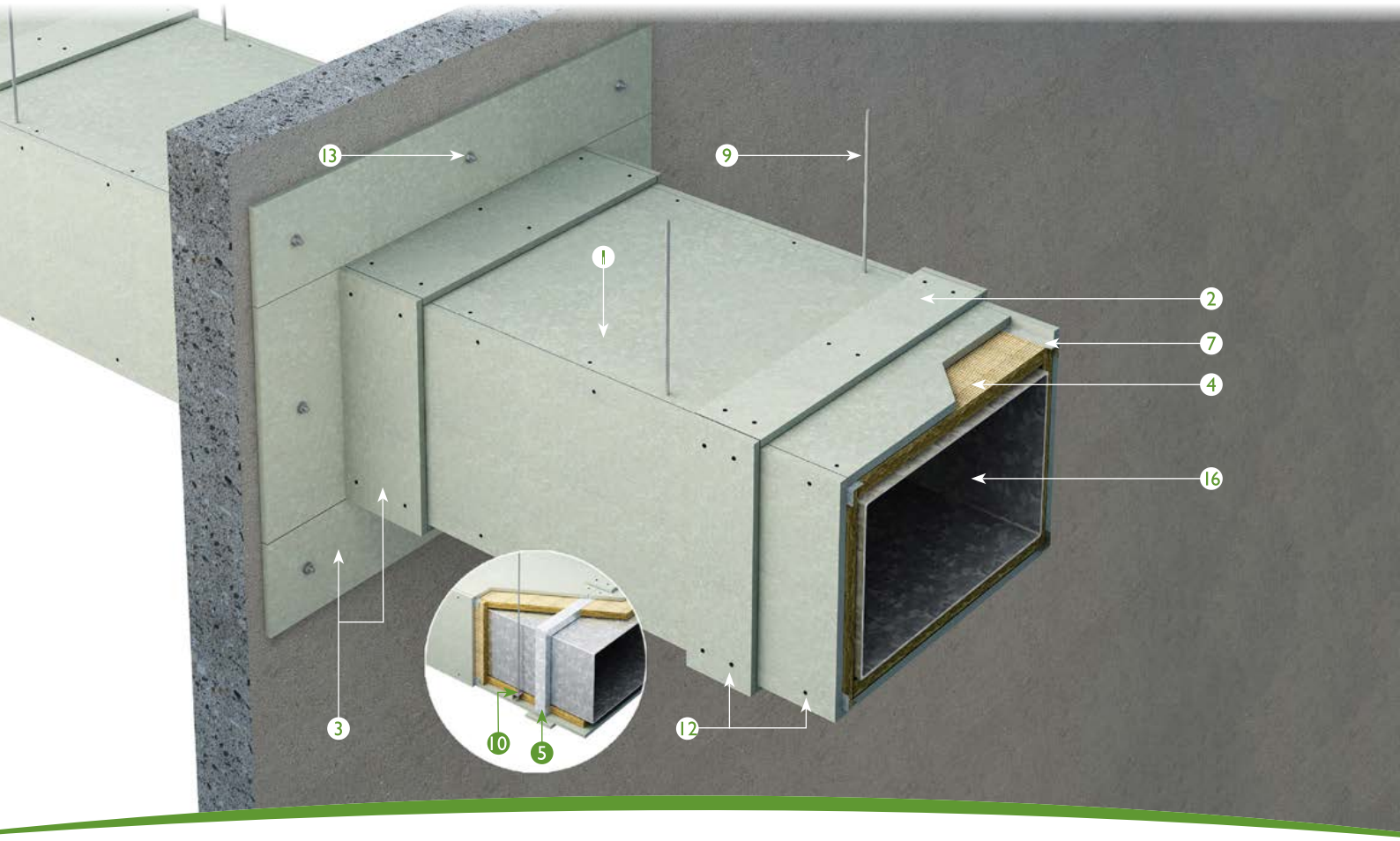
SYSTEM

Duct thickness	62mm up
Surface mass	19.00 kg/m^2 up

* STC / Rw values within +/-3dB

Fire inside or outside





INSTALLATION

FP®-900/FirePro® Fire Rated Ventilation Steel Duct systems should be constructed in accordance with the approved specification mentioned in the manufacturer's technical handbook & the local building regulations (if required).

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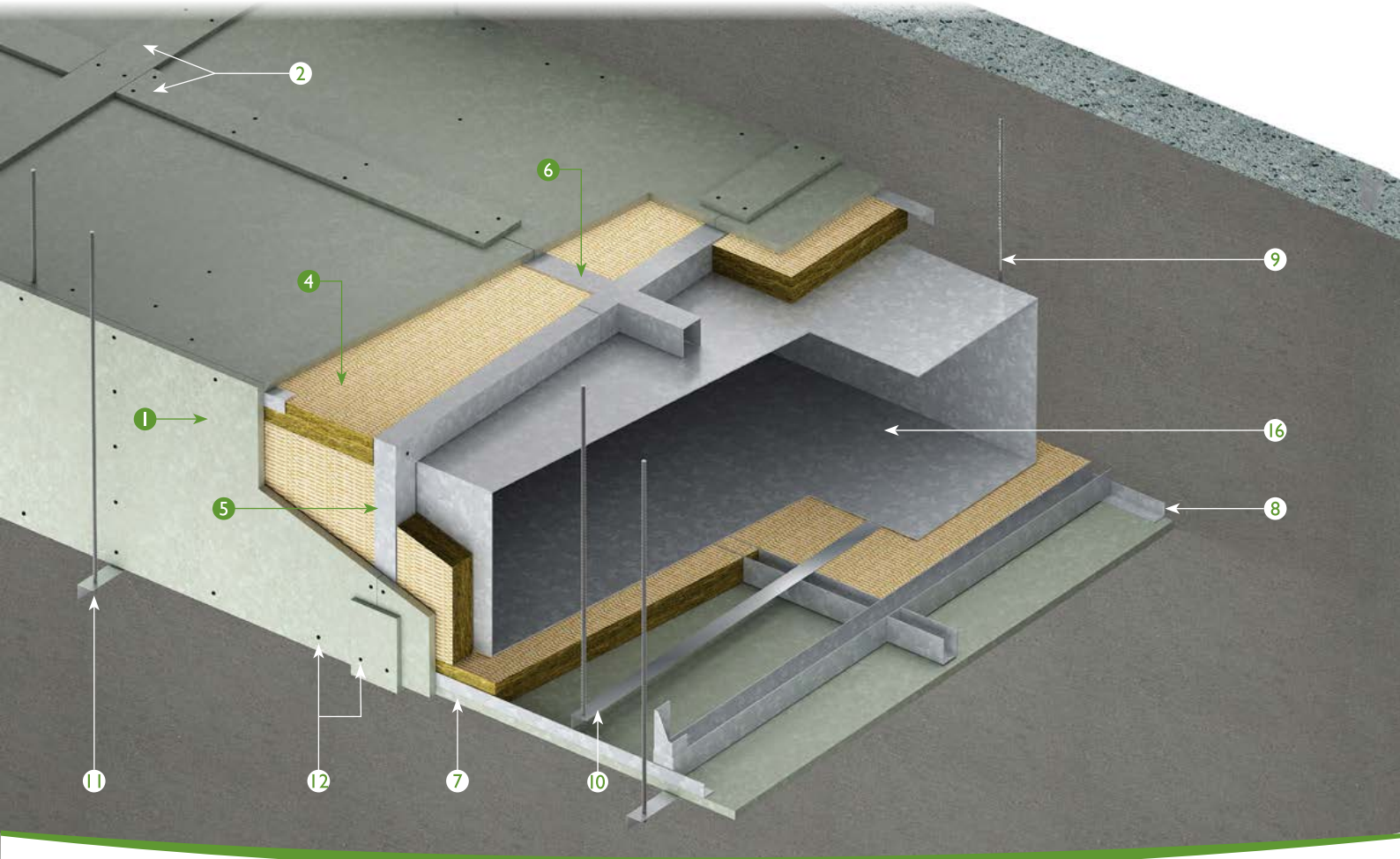
TECHNICAL DATA

1. FP-900®/FirePro® - 14mm thick for FRL: 120/120/120, (other fire ratings refer to table D1)
2. FP-900®/FirePro® cover strip - 12mm thick x 100mm wide, except no cover strip for FRL 240/240/240 Duct A with 2 layers of 9mm thick board
3. FP-900®/FirePro® collar 150mm x 14mm thick at wall or floor penetration
4. Stone wool - 50mm x 100kg/m^3 for FRL: 120/120/120, (other fire ratings refer to table D1)
5. G.I. channel collar 50 x 50 x 50 x 0.8mm thick, maximum area of unsupported board = 1.5 m^2
6. G.I. channel intermediate support
   - 50 x 50 x 50 x 0.8mm - duct width up to 3m
   - 40 x 50 x 40 x 0.8mm formed by back to back or boxed section - duct width up to 7.5m
7. G.I. angle 50 x 50 x 0.8mm thick
8. G.I. angle 50 x 50 x 1.2mm fixed to concrete/block structure
9. Steel threaded hanger rod minimum ø8 mm#
10. Steel angle support minimum 50 x 50 x 5mm thick#
11. Additional steel threaded hanger rod and steel support if necessary#
12. M4 self-tapping screw at 200mm centres
13. M8 metal anchor bolt at 400mm centres
14. G.I. angle collar 150 x 100 x 0.8mm thick at wall or floor penetration
15. Stone wool tightly packed into aperture and duct
16. Minimum 0.6mm thick G.I. sheet metal duct according to DW/144 Spec

tensile stress limit not exceeding

fire rating	stress limit
60 minutes	15N/mm^2
120 minutes	10N/mm^2
180 minutes	8N/mm^2
240 minutes	6N/mm^2



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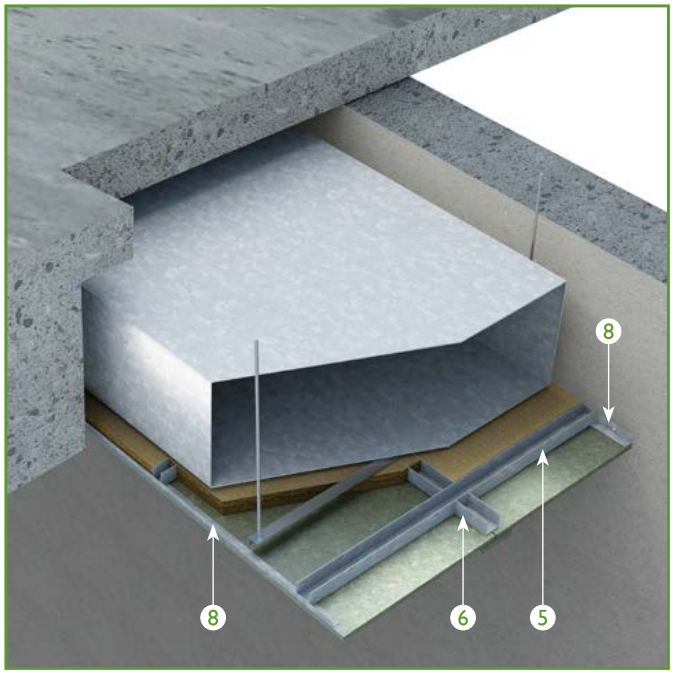
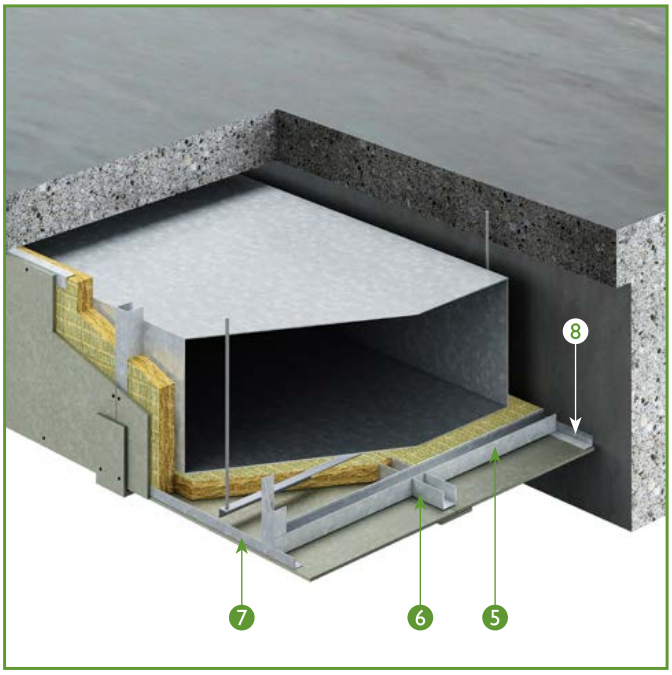
APPLICATION

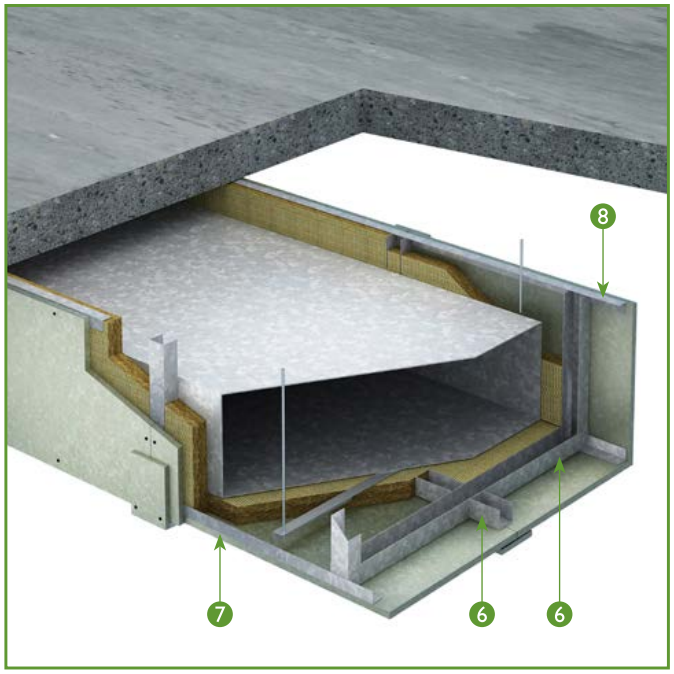
FP®-900/FirePro® fire rated ventilation steel duct, smoke extract duct and kitchen extract duct systems provide great flexibility to meet different ventilation criteria of individual building. These include large single duct of sizes up to 7.5m wide x 2.5m high for one, two, three and four sided protection, multiple side by side ducts and two tier ducts with modification for vertical and horizontal installation. Typical installation methods are depicted below.



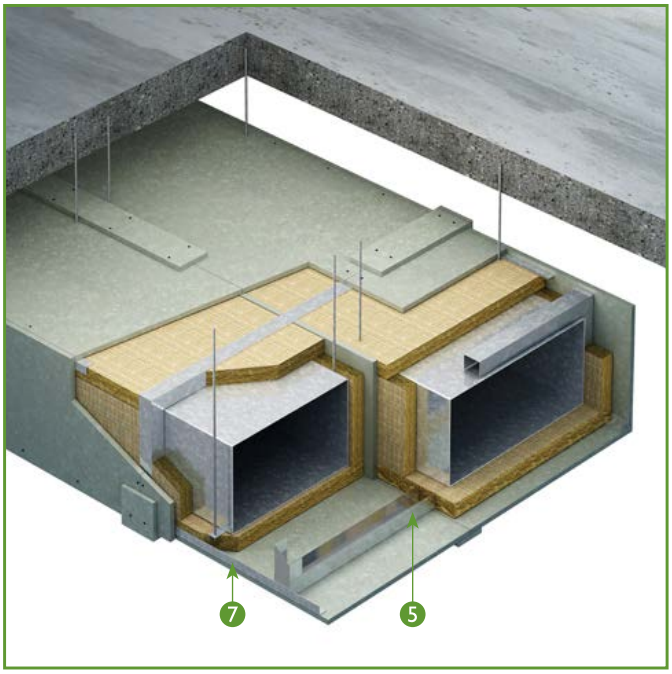
ONE SIDED DUCT



TWO SIDED DUCT



THREE SIDED DUCT



MULTIPLE SIDE BY SIDE DUCTS

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SPECIFICATION

FP®-900/FirePro® duct systems have been tested to BS 476: Part 24 and demonstrated fire resistance of up to 240 minutes. A full appraisal of duct systems for various applications has been issued by Exova Warringtonfire UK, an accredited and internationally recognised fire testing laboratory.

The steel ventilation, smoke extract and kitchen extract duct systems clad with FP®-900/FirePro® calcium silicate board provide a fire resistance of 60/120/180/240 minutes in terms of the stability and integrity criteria of BS 476: Part 24-1987 (ISO 6944-1985) and 0/30/60/120/180/240 minutes in terms of the insulation criterion of the standard, with fire attack from either inside (Duct B) or outside (Duct A) the duct. The thicknesses of FP®-900/FirePro® and stone wool for the various fire resistance ratings are given in Table D1.

TABLE D1

System	FIRE RESISTANCE - MINUTES			DUCT A	
	Stability	Integrity	Insulation	FP-900/FirePro - mm	Stone wool - mm x kg/m³
A1	60	60	-	12	-
A2	60	60	60	12	30 x 60
A3	120	120	-	12	-
A4	120	120	30	12	25 x 60-
A5	120	120	60	12	30 x 60
A6	120	120	120	12	50 x 60
A7	180	180	180	14	50 x 100
A8	240	240	-	12	-
A9	240	240	30	14	25 x 60
A10	240	240	60	14	30 x 60
A11	240	240	120	14	50 x 60
A12	240	240	180	14	50 x 100
A13	240	240	240	18 or 2 x 9	50 x 120

System	FIRE RESISTANCE - MINUTES			DUCT B	
	Stability	Integrity	Insulation	FP-900/FirePro - mm	Stone wool - mm x kg/m³
B1	60	60	-	12	-
B2	60	60	60	12	50 x 60
B3	120	120	-	12	-
B4	120	120	30	12	30 x 60
B5	120	120	60	12	50 x 60
B6	120	120	120	14	50 x 100

System	FIRE RESISTANCE - MINUTES			KITCHEN EXTRACT DUCT (1)	
	Stability	Integrity	Insulation	FP-900/FirePro - mm	Stone wool - mm x kg/m³
B4	120	120	30	12	50 x 60
B5	120	120	60	12	50 x 80

Note: non-mandatory annex to BS 476: Part 24: 1987 required for kitchen extract duct

System	FIRE RESISTANCE - MINUTES			KITCHEN EXTRACT DUCT (2)	
	Stability	Integrity	Insulation	FP-900/FirePro - mm	Stone wool - mm x kg/m³
B2	60	60	60	12	50 x 60
B6	120	120	120	14	50 x 100

Note: non-mandatory annex to BS 476: Part 24: 1987 not required for kitchen extract duct

AN EXAMPLE FOR CALCULATING STEEL HANGER SUPPORTS

Given:

- Fire rating = 120 minutes
- Density of board= 990kg/m^3 (with 10% allowance)
- Density of stone wool = 100kg/m^3
- Density of steel = 7850kg/m^3
- Steel hanger rod at 1000mm centres
- Maximum allowable steel stress ≤ 10N/mm^2 for 120 minutes fire rating

Checking:

❶ Maximum allowable load applied on M10 steel hanger rod
= 10N/mm2 x 58.08mm^2 = 581N

❷ Total allowable load on 2 Nos. x M10 steel hanger rod
= 2 x 581 = 1162N

❸ Total weight of FP®-900/FirePro® ventilation duct enclosure system for each section supported by steel hanger at1000mm centre
$WT = W_1 + W_2 + W_3 + W_4 + W_5 + W_6 + W_7 + W_8$
WT = 962N ≤ 1162N

❹ So the steel hanger rod with size M10 is acceptable.

WEIGHT OF DUCT ASSEMBLY

Component of Duct	Size		Weight - N
Steel duct size:	1000mm x 250mm (width x height) 0.8mm thick of steel sheet	W_1	154.0
Steel channel collar	50 x 50 x 50 x 0.8mm thick at 600mm centres	W_2	46.2
Steel angle	50 x 50 x 0.8mm thick	W_3	24.6
Steel angle bearer	50 x 50 x 5mm thick	W_4	42.4
FP®-900/FirePro® board	14mm thick	W_5	402.2
FP®-900/FirePro® cover strip	100mm width x 12mm thick	W_6	81.7
Stone wool	50mm thick	W_7	142.2
Miscellaneous	steel hanger rods and self-tapping screws	W_8	68.7
		Total W_T	962.0

EFFECTIVE CROSS SECTIONAL AREA OF STEEL HANGER RODS

Hanger Rod	Root Diameter -mm	Cross Sectional Area - mm^2
M6	5.06	20.10
M8	6.83	36.63
M10	8.60	58.08
M12	10.36	84.29
M14	12.25	117.85
M16	14.14	157.03

HEALTH, SAFETY & SITE WORK GUIDANCE

HEALTHY & SAFETY

Processing

As for all other building materials, safety precautions must be taken into account and local laws and regulations must be observed. Working with board at well-ventilated area, cutting and drilling are subject to dust development, and proper precautions must be taken by using appropriate dust extraction equipment.

Horizontal boards or ceiling boards must not be walked on as they are not designed to take additional loads between supports. If there is a risk as this occurring, warning notices should be displayed. Installers must ensure that they work from adequate and safe platform where necessary.

Cutting

Cutting to size may be done with normal slow or fast running hand tools or stationary equipment. When using fast running tools, dust exhaustion must be employed. All Soben International's board products may be cut with a circular saw or a jigsaw equipped with tungsten carbide or diamond tipped blade.

Applications instructions

Further information is available from our website www.sobenboard.com.

HANDLING AND STORAGE

Manual Handling

European or local manual handling regulations applies for any heavy loading practices in order to minimize the risk of accidents to the handlers and also the possible damage to the product.

- Always lift boards off the board below, never slide board on board or drag the stack.
- Always carry the boards on edge, but do not store on edge.
- Never carry the boards on edge horizontally, it may cause the board broken easily

Mechanical Handling

Mechanical handling is preferred. If machine is not available, boards can also be removed manually.

Personal Protective Equipments

The best practice for work safety & occupational health should be for workers to use dust masks to prevent dust inhalation. Working clothes is preferred to be long sleeve shirts, trousers and hats to prevent direct contact with skin. Gloves should be worn at all time to prevent cuts.

Storage

Soben International's board products are delivered with plastic protection cover on the pallet against weather conditions during transportation. They are preferred to be stored inside and undercover in a dry and flat level surface on pallets or sleepers with maximum 400 mm distance, maximum 3 pallets in a stack. Stacks of loose boards should not exceed 1m (height). If the products have to be stayed outdoor temporarily, a weatherproof tarpaulin is recommended to wrap over to provide protection.

When the products get wet, moved them to a dry area with good ventilation and let them dry out naturally. It will not degrade the board themselves.

INFORMATION

Please, ensure that you have the latest version of this publication by checking that the publication date corresponds with the downloadable version from our website. In case of doubt, please contact your local Soben International representative.

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