CERTIFICATE OF APPROVAL
No. ME0196

This is to certify that the referenced product of

FIRESPRAY INTERNATIONAL LTD

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has been assessed against the requirements of the W*arringtonfire – mideast certification scheme* and is approved for use within the scope of any test and/or assessment report(s) referenced.

FLAMEBAR BW11 INSULATED & UNINSULATED STEEL VENTILATION DUCT SYSTEMS

This Assessment Summary has been prepared by **Warringtonfire** and is a summary of the assessment reports referenced below. Full details of the constructions, justification for the conclusions given, along with validity statements are given in those reports and the supporting test reports.

This summary sheet covers the fire resistance performance of FLAMEBAR BW11 INSULATED & UNINSULATED STEEL VENTILATION DUCT SYSTEMS as previously fire tested by and subsequently assessed by BRE to BS 476: Part 24: 1987 (ISO 6944: 1985) 'Method for the determination of the fire resistance of ventilation ducts' and up to the periods shown below.

Assessment Report Reference	Valid Until
BRE Assessment Report No. CC 88343 Review 3	9th February 2014

For the duct pressure classifications referred to in this certificate and for some of the construction requirements for the ductwork system, reference is made to DW/144 - Specification for Sheet Metal Ductwork – Low, medium and high pressure/velocity air systems. Published by the Heating and Ventilating Contractors Association (HVCA) – 1998.

Also referenced in this certificate is HVCA Duct Construction Standards – Metal and Flexible, published by the Sheet Metal and Air Conditioning Contractors National Association, Inc.

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FLAMEBAR BW11 INSULATED & UNINSULATED STEEL VENTILATION DUCT SYSTEMS

Scope: Mild steel, galvanised steel or stainless steel ventilation ducts, smoke extract/outlet ducts and kitchen extract ducts coated with Flamebar BW11 Fire Proofing with a nominal dry film thickness of 0.7 to 1.0mm.

Orientation: Horizontal and vertical.

Insulation: Uninsulated and insulated.

Maximum fire resistance periods:

Fire outside (duct A) – 240 minutes integrity and 240 minutes insulation.
Fire inside (duct B) - 240 minutes integrity and 120 minutes insulation

Flamebar Construction Standards Drawings:

Appendix 1 contains 62 current construction standards detailing the manufacturing and installation details of the Flamebar BW11 duct systems. The standards drawings include details of ventilation ducts, smoke extract ducts, kitchen extract ducts, rectangular ducts, circular ducts, flat oval ducts, insulation, access doors and other construction details.

Rectangular ducts

The minimum construction requirements for the steel duct are as follows:

- Wall thickness - minimum 0.6mm-thick steel sheet,
- Longitudinal seams - Pittsburgh Lock or Grooved Corner Seam,
- Cross joints - rolled steel angle flanged cross-joints or equivalent roll-formed sheet steel profile cross-joints,
- Maximum section length - 1510mm,
- Maximum size – 3000mm wide x 2000mm high.

Stiffeners:

For duct sections with a size of more than 400mm longer side, the duct is fitted with stiffeners of at least S2 (DW/144) rating, as listed in the Flamebar Construction Standards Drawings. The stiffeners are fitted on all four sides and welded at the corners.

Duct supports:

Horizontal duct assemblies are supported by steel hangers that comprise a threaded steel studding drop rod on each side of the duct and a bearer (angle, slotted channel or channel) under the duct. Where duct systems exceed the tested duct dimensions the hangers (drop rods and bearers) supporting the duct assembly are increased in size to accommodate the extra loading imposed by the self-weight of the duct and any insulation.

For insulated horizontal ducts, the steel bearer of each hanger at the base of the duct supports a spreader plate comprising a calcium silicate board spacer, 100mm wide x thickness of insulation material. Alternatively the calcium silicate board spacer may be made up with layers of the board to be of at least the same thickness as the insulation. The maximum design stresses that unprotected steel hangers can bear in the standard fire test are given in Table 1.

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Table 1 Maximum stress in steel hangers

Fire resistance period - minutes	30	60	90	120	180	240
Stress limit – N/mm^2	25	15	12	10	8	6

The maximum spacing of the hangers is 1500mm centres.

***Vertical ducts**:*
The construction of vertical ducts is the same as for horizontal ducts. In order to support the duct system in the vertical orientation, steel sections are fastened to the steel duct, either along the two longer or shorter sides or on all four sides. The steel sections either span across the opening in the concrete floor or form part of a cantilever bracket that is fastened to the building structure. Details of the support of vertical ducts are given in Flamebar Construction Standards Drawing No. STD 1028 'D'.

Penetration seal:
The penetration seal systems, where the duct passes through fire compartment walls or floors, are very similar to those tested. They comprise either a rock wool infill with calcium silicate board collars on both faces of the wall or floor, or an infill of FPS 1000 compound.

Insulation:
A single or double layer of rock wool insulation is fastened to the outside of the duct. The insulation is either in wrap form, held in position with chicken wire mesh and steel bands, or in slab form held in position with steel bands and pins.

The wrap insulation is held in position with 19mm-wide x 0.5mm-thick stainless steel bands at 300mm maximum centres. The joints in the insulation must be tight butt joints, where the rock wool is compressed together, or there is a nominal 50mm overlap. On the soffit of ducts over 600mm wide a row of steel pins and steel non-return washers, which are welded or riveted with steel rivets to the steel duct, are fitted at mid-width of the soffit at 500mm nominal centres. An extra row of pins is fitted for each 500mm increase in width. For steel ducts over 600mm high one row of pins at 600mm maximum centres is fitted to each side of the duct at about mid-height. An extra row of pins is fitted for each extra 600mm in height.

The slab insulation is held in position with 19mm-wide x 0.5mm-thick stainless steel bands at 400mm maximum centres. The insulation at the sides and soffit of the duct is also fastened with steel pins and steel non-return washers, which are welded or riveted with steel rivets to the steel duct. The pins on the duct soffit are spaced in a grid with maximum dimensions of 500mm in both directions, those adjacent to the longitudinal corners of the soffit being not more than 50mm from the corner of the steel duct. Also, on the soffit, the pins adjacent to transverse slab joints and longitudinal slab joints (other than the corner joints) are not more than 100mm from the joint. For steel ducts up to 1200mm high, one row of pins at 600mm maximum centres is fitted to each side of the duct at about mid-height. For steel ducts over 1200mm high (i.e. where there are longitudinal joints in the slabs on the sides of the duct) the pins are fitted in a grid of maximum size 600mm x 400mm, which results in at least four pins per 1200mm x 600mm slab. The corner joints in the slabs are bonded with Flamebar Insulation adhesive for fire ratings over 120 minutes. For fire ratings up to 120 minutes the Flamebar Insulation adhesive may be fitted instead of the steel bands.

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Where cover strips are required over duct section joints, stiffeners and slab joints they consist of strips of the same rock wool insulation, with a minimum size of 75mm wide x 25mm thick. They are fastened in position with Flamebar Insulation adhesive or steel pins and washers.

Where the proximity of a duct to a wall allows the duct insulation to be fitted but insufficient room for the steel pins to be installed (e.g. gap sizes up to 150mm wide) an additional row of pins must be fitted to the soffit of the duct 50mm from the edge of the inaccessible side at 500mm maximum centres. Steel angle brackets, 100mm x 75mm x 1.2mm thick x 100mm long, are fastened to the adjacent wall, through the 75mm leg, to support the bottom of the insulation. The brackets are fitted at 300mm nominal centres, each fastened with an M6 all-steel expanding anchor, or equivalent. All slab joints of the insulation are bonded with Flamebar Insulation adhesive. The maximum fire rating for this arrangement is 120 minutes.

The required thicknesses of rock wool insulation are given in Tables 2 to 4.

3-sided ducts:
A 3-sided duct butts up to the soffit of a concrete floor. The general construction is the same as a 4-sided duct except that no hanger supports are required. The duct is fabricated in the form of a 'U' with the top edges having an outward facing flange of 50mm minimum width. A minimum 50mm x 50mm x 3mm thick steel angle is used to clamp the flanges to the floor using minimum M6 all-steel expanding anchors at 250mm nominal centres. For installations where an insulation rating is required, additional rock wool insulation is fitted over the angles.

2-sided & 1-sided ducts:
The construction of 2-sided and 1-sided ducts follows the same technique as for 3-sided ducts. Where the duct is fastened to a masonry or concrete wall the same angle fixing procedure is used as for the concrete soffit on 3-sided ducts.

Larger ducts:
For steel ducts larger than 3m x 2m the design and construction of the ducts is shown in Flamebar Construction Standards Drawing No. STD 1011 'E'. The L-sections, U-sections and panels are made of steel sheet with a framing of steel angles, 50mm x 50mm x 3mm thick. The steel sheet is fastened to the angles with Huckbolts or spot welds at 75mm nominal centres. The sections are fastened together with M10 steel bolts at 150mm nominal centres.

Where the duct width exceeds 2000mm, a central drop rod (same size as primary drop rods) is incorporated which supports the bottom of the duct (via the steel bearer) and also the top of the duct using a steel nut and large steel washer. For ducts wider than 4m an additional drop rod is fitted at each hanger support for each extra 2m, or part 2m, width. At penetrations through compartment walls a steel tie rod, as detailed in Flamebar Construction Standards Drawing No. STD 1011 'E', is fitted at the same 2m maximum centres. On vertical ducts the tie rods are fitted at each flanged duct joint at the same 2m centres. The maximum size of duct is 25m wide x 3m high.

Access doors:
Details of the construction and installation of access doors are shown in Flamebar Construction Standards Drawing No. STD 1001 'F'.

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Circular & flat oval ducts

The minimum construction requirements for circular and flat-oval straight seamed and spirally wound steel ductwork are as follows:

- Wall thickness - minimum 0.6mm-thick steel sheet,
- Longitudinal seams - Grooved Seam or equivalent,
- Cross joints – socket and spigot joint (up to 800mm diameter circular and up to 520mm major axis flat oval), or rolled steel angle flanged cross-joints or equivalent roll-formed sheet steel profile cross-joints,

The spiral seam of spirally wound ducts must be at least equivalent to the grooved seam.

For flat oval ducts over 520mm wide x 150mm deep, tie rods, with a minimum diameter of 12mm, must be fitted between the top and bottom walls of the flat portion of the duct, as follows:

- for ducts between 520mm wide and 680mm wide, one tie rod is located at mid-width of the duct at 1000mm centres along the duct.
- for ducts between 681mm wide and 1160mm wide, one tie rod is located at mid-width of the duct at 750mm centres along the duct.
- for ducts between 1161mm wide and 1480mm wide, two tie rods are equi-spaced across the duct at 500mm centres along the duct.
- for ducts between 1481mm wide and 1640mm wide, tie rods are spaced at 250mm centres along the duct, alternating between one tie rod centrally located and two tie rods equi-spaced across the duct.

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Table 2 Specification of rock wool insulation for ventilation ducts

Duct type	Density of insulation	Insulation thickness	Fire resistance period - minutes	
			Stability & integrity	Insulation
Fire outside duct (type A)	-	-	120	15
	-	-	240	15
	45kg/m^3	25mm	120	60
	45kg/m^3	60mm	120	60
	60kg/m^3	40mm	120	90
	60kg/m^3	50mm	120	118
	60kg/m^3	120mm	120	120
	105kg/m^3	50mm	120	120
	105kg/m^3	80mm	120	120
	105kg/m^3	50mm	240	208
	60kg/m^3	120mm	240	240
	105kg/m^3	80mm	240	240
	105kg/m^3	120mm	240	240
	105kg/m^3	100mm[1]	240	240
Fire inside duct (type B)	-	-	120	-
	-	-	240	-
	45kg/m^3	25mm	120	30
	45kg/m^3	60mm	120	30
	60kg/m^3	50mm	120	45
	105kg/m^3	50mm	120	60
	60kg/m^3	120mm	120	90
	105kg/m^3	80mm	120	90
	105kg/m^3	120mm	120	120
	60kg/m^3	120mm	240	90
	105kg/m^3	80mm	240	90
	105kg/m^3	120mm	240	120
	105kg/m^3	100mm[1]	240	120

Note 1 – Includes 500mm x 25mm thick x 105kg/m^3 density rock wool collar around duct on both sides of penetration seal through fire compartment wall or floor.
Note 2 – The 50mm thick x 60kg/m^3 density rock wool insulation may be in the form of either slabs or wrap.

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Table 3 Specification of rock wool insulation for smoke outlet ducts

Duct type	Density of insulation	Insulation thickness	Fire resistance period - minutes	
			Stability & integrity	Insulation
Fire outside duct (type A)	-	-	120	15
	-	-	240	15
	45kg/m^3	25mm	120	60
	45kg/m^3	60mm	120	60
	60kg/m^3	40mm	120	90
	60kg/m^3	50mm	120	118
	60kg/m^3	120mm	120	120
	105kg/m^3	50mm	120	120
	105kg/m^3	80mm	120	120
	105kg/m^3	50mm	240	208
	60kg/m^3	120mm	240	240
	105kg/m^3	80mm	240	240
	105kg/m^3	120mm	240	240
	105kg/m^3	100mm[1]	240	240
Fire inside duct (type B)	-	-	120	-
	-	-	240	-
	45kg/m^3	25mm	120	30
	45kg/m^3	60mm	120	30
	60kg/m^3	50mm	120	45
	105kg/m^3	50mm	120	60
	60kg/m^3	120mm	120	90
	105kg/m^3	80mm	120	90
	105kg/m^3	120mm	120	120
	60kg/m^3	120mm	240	90
	105kg/m^3	80mm	240	90
	105kg/m^3	120mm	240	120
	105kg/m^3	100mm[1]	240	120

Note 1 – Includes 500mm x 25mm thick x 105kg/m^3 density rock wool collar around duct on both sides of penetration seal through fire compartment wall or floor.
Note 2 – The 50mm thick x 60kg/m^3 density rock wool insulation may be in the form of either slabs or wrap.

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Table 4 Specification of rock wool insulation for kitchen extract ducts or ducts containing combustible linings

Duct type	Density of insulation	Insulation thickness	Fire resistance period - minutes	
			Stability & integrity	Insulation
Fire outside duct (type A)	-	-	120	-
	-	-	240	-
	60kg/m^3	50mm	120	28*
	60kg/m^3	60mm	120	30*
	105kg/m^3	50mm	120	44*
	60kg/m^3	120mm	120	45*
	105kg/m^3	80mm	120	45*
	105kg/m^3	50mm	240	44*
	60kg/m^3	120mm	240	45*
	105kg/m^3	80mm	240	45*
	105kg/m^3	120mm	240	60*
	105kg/m^3	100mm[1]	240	60*
Fire inside duct (type B)	-	-	120	-
	-	-	240	-
	45kg/m^3	25mm	120	30
	45kg/m^3	60mm	120	30
	60kg/m^3	50mm	120	45
	105kg/m^3	50mm	120	60
	60kg/m^3	120mm	120	90
	105kg/m^3	80mm	120	90
	105kg/m^3	120mm	120	120
	60kg/m^3	120mm	240	90
	105kg/m^3	80mm	240	90
	105kg/m^3	120mm	240	120
	105kg/m^3	100mm[1]	240	120

* - Refers to internal face inside furnace.
Note 1 – Includes 500mm x 25mm thick x 105kg/m^3 density rock wool collar around duct on both sides of penetration seal through fire compartment wall or floor.
Note 2 – The 50mm thick x 60kg/m^3 density rock wool insulation may be in the form of either slabs or wrap.

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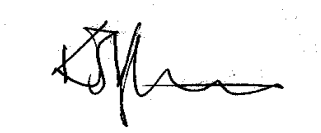
Certification is awarded on the basis of initial type testing to BS 476: Part 24, initial inspection and ongoing surveillance of factory production control, and ongoing compliance with the scheme requirements including the use of labels supplied by **warringtonfire**. The currency of the certification may be verified at www.warringtonfire.net/mideast.

Signed for and on behalf of Warrington Certification



Sir Ken Knight
Chairman - Management Council

Issued: 17th February 2010
Valid to: 16th February 2015

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FLAMEBAR BW11 INSULATED & UNINSULATED STEEL VENTILATION DUCT SYSTEMS

Appendix 1 – Flamebar Construction Standards

Drawing no.	Details
STD0200 'M'	Flamebar BW11 rectangular 2 hour fire duct, fire inside or outside, Class 'D'.
STD0201 'M'	Flamebar BW11 rectangular 2 hour smoke extract duct, fire inside or outside, Class 'D'.
STD0202 'M'	Flamebar BW11 rectangular 2 hour kitchen extract duct, fire inside or outside, Class 'D'.
STD0203 'M'	Flamebar BW11 rectangular 4 hour fire duct, fire inside or outside.
STD0204 'L'	Flamebar BW11 rectangular 4 hour smoke extract duct, fire inside or outside.
STD0205 'M'	Flamebar BW11 rectangular 4 hour kitchen extract duct, fire inside or outside.
STD0206 'J'	Flamebar BW11 rectangular 2 hour low velocity fire duct, fire inside or outside, Class 'A'.
STD0207 'H'	Flamebar BW11 rectangular 2 hour low velocity smoke extract duct, fire inside or outside, Class 'A'.
STD0208 'J'	Flamebar BW11 rectangular 2 hour low velocity kitchen extract duct, fire inside or outside, Class 'A'.
STD0210 'K'	Flamebar BW11 circular 2 hour fire duct, fire inside or outside.
STD0211 'K'	Flamebar BW11 circular 2 hour smoke extract duct, fire inside or outside.
STD0212 'L'	Flamebar BW11 circular 2 hour kitchen extract duct, fire inside or outside.
STD0213 'J'	Flamebar BW11 circular 4 hour fire duct, fire inside or outside.
STD0214 'K'	Flamebar BW11 circular 4 hour smoke extract duct, fire inside or outside.
STD0215 'K'	Flamebar BW11 circular 4 hour kitchen extract duct, fire inside or outside.
STD0220 'G'	Flamebar BW11 flat oval 2 hour fire duct, fire inside or outside.
STD0221 'G'	Flamebar BW11 flat oval 2 hour smoke extract duct, fire inside or outside.
STD0222 'H'	Flamebar BW11 flat oval 2 hour kitchen extract duct, fire inside or outside.
STD0223 'G'	Flamebar BW11 flat oval 4 hour fire duct, fire inside or outside.
STD0224 'G'	Flamebar BW11 flat oval 4 hour smoke extract duct, fire inside or outside.
STD0225 'H'	Flamebar BW11 flat oval 4 hour kitchen extract duct, fire inside or outside.
STD0230 'G'	Flamebar BW11 rectangular 2 hour fire duct, fire inside or outside, Class 'B'.
STD0231 'G'	Flamebar BW11 rectangular 2 hour fire duct, fire inside or outside, Class 'C'.
STD0232 'F'	Flamebar BW11 rectangular 2 hour smoke extract duct, fire inside or outside, Class 'B'.
STD0233 'F'	Flamebar BW11 rectangular 2 hour smoke extract duct, fire inside or outside, Class 'C'.
STD0234 'G'	Flamebar BW11 rectangular 2 hour kitchen extract duct, fire inside or outside, Class 'B'.
STD0235 'G'	Flamebar BW11 rectangular 2 hour kitchen extract duct, fire inside or outside, Class 'C'.
STD0250 'G'	Flamebar BW11 rectangular 2 hour fire duct, fire inside or outside, based on SMACNA figure nos. (metric).
STD0251 'G'	Flamebar BW11 rectangular 2 hour fire duct, fire inside or outside, based on SMACNA figure nos. (imperial).
STD0252 'G'	Flamebar BW11 rectangular 2 hour smoke extract duct, fire inside or outside, based on SMACNA figure nos. (metric).
STD0253 'G'	Flamebar BW11 rectangular 2 hour smoke extract duct, fire inside or outside, based on SMACNA figure nos. (imperial).

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Appendix 1 – Flamebar Construction Standards – cont'd

Drawing no.	Details
STD0254 'H'	Flamebar BW11 rectangular 2 hour kitchen extract duct, fire inside or outside, based on SMACNA figure nos. (metric).
STD0255 'H'	Flamebar BW11 rectangular 2 hour kitchen extract duct, fire inside or outside, based on SMACNA figure nos. (imperial).
STD0350 'J'	Flamebar BW11 rectangular fire duct, fire outside, based on SMACNA standards (metric).
STD0351 'K'	Flamebar BW11 rectangular fire duct, fire outside, based on SMACNA standards (imperial).
STD1000 'D'	Rolled steel angle and flat bar flange drilling details.
STD1001 'F'	Fire duct access door details.
STD1010 'F'	Connection of control devices to Flamebar BW11 fire duct.
STD1011 'E'	Construction of Flamebar BW11 fire ducts up to 25m wide x 3m high.
STD1017 'F'	Fire rated smoke balancing dampers for Flamebar BW11 fire ducts.
STD1024 'E'	Construction of Flamebar BW11 fire duct transformation pieces.
STD1025 'F'	Construction of Flamebar BW11 fire duct square bends.
STD1026 'E'	Construction of Flamebar BW11 fire duct radius bends.
STD1028 'D'	Construction of Flamebar BW11 vertical fire duct supports.
STD1032 'B'	Standard 50mm (60kg/m^3) insulation method.
STD1033 'B'	Standard 120mm (110kg/m^3) insulation method (2 layers).
STD1034 'B'	Alternative 120mm (110kg/m^3) insulation method (2 layers).
STD1035 'B'	Standard 120mm (110kg/m^3) single layer insulation method.
STD1036 'B'	Alternative 120mm (110kg/m^3) single layer insulation method.
STD1037 'B'	Standard 25mm (45kg/m^3) insulation method.
STD1039 'A'	Alternative 75mm (110kg/m^3) single layer insulation method.
STD1040 'A'	Standard 50mm (110kg/m^3) insulation method.
STD1041 'A'	Insulation pin arrangement for single and double layer.
STD1042 'A'	Standard 50mm (60kg/m^3) insulation method.
STD1043 'A'	Insulation – approved support methods.
STD1044 'A'	Standard 50mm (105kg/m^3) mattress insulation method.
STD1045 'A'	Standard 120mm (105kg/m^3) mattress insulation method (2 layers).
STD1046 'O'	Standard 100mm (110kg/m^3) insulation method (2 layers).
STD1047 'O'	Alternative 100mm (110kg/m^3) insulation method (2 layers).
STD1048 'O'	Standard 100mm (110kg/m^3) single layer insulation method.
STD1049 'O'	Alternative 100mm (110kg/m^3) single layer insulation method (sheets 1 & 2).
STD1054 'O'	Standard 80mm (110kg/m^3) insulation method (2 layers).