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# INTERNATIONAL FIRE CONSULTANTS LIMITED

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## IFC ASSESSMENT REPORT

**PAR/14600/01**

### **Assessment of Tenmat Firefly 109+ Fire Sleeves when fitted to PVC vent ducts penetrating plasterboard clad, steel stud, fire resisting partitions**

Prepared on behalf of:

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Author	MB					
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IFC Assessment Report  
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## 1. INTRODUCTION

This report has been prepared by International Fire Consultants Ltd (IFC) to determine the contribution provided by Firefly 109+ Fire Sleeves, when fitted to PVC vent ducts passing through fire resisting partitions; in terms of their ability to maintain the fire resistance performance of the partition, at the location of the penetration, if the partitions were to be tested to the integrity and insulation criteria of BS476: Part 20: 1987 for up to 120 minutes. IFC have performed the evaluations/analysis, and preparation of the assessment report, on the instruction of Tenmat Ltd.

Fire resisting constructions are rarely supplied in an identical form to that which was tested. The specification will invariably require the construction to be used at a size, or with a penetration, which is different from that tested. The result of a fire resistance test can apply to variations in constructions as long as they do not reduce the performance to one which is below that specified.

When establishing the variations in the construction that can achieve the required fire resistance performance, International Fire Consultants Ltd follows the guidance given in BS.ISO/TR12470: 1998, *"Fire resistance tests - Guidance on the application and extension of results"*. Where constructional or manufacturing details are not specified, or discussed herein, it should not, therefore, be taken to infer approval of variation in such details from those tested or otherwise approved.

The assessment is based upon the information supplied to IFC (detailed in the Section 2) and upon the fire resistance test evidence detailed in Section 3. An analysis of the fire resistance performance of the product, in the proposed applications, is presented in Section 4.

## 2. PROPOSAL

It is proposed that Firefly 109+ Fire Sleeves, when fitted to PVC vent ducts passing through fire resisting partitions, would maintain the fire resistance performance of the partition, at the location of the penetration, if a representative specimen of the partition, and associated penetrations, were to be tested to the integrity and insulation criteria of BS476: Part 20: 1987 for up to 120 minutes.

The specification of the Firefly 109+ Fire Sleeves <sup>Note 1</sup> is summarised in Section 2.1 below. This report refers specifically to bespoke installation details, which are summarised in Section 2.2 below.

*Note 1 Tenmat also manufacture a range of products called 'Firefly 109 Fire Sleeve', which have a 25mm thick annular wall. This report, and the approval herein, only applies to the Firefly 109+ Fire Sleeve, with nominally 10-15mm thick annular walls.*

## 2.1 Tenmat Firefly 109+ Fire Sleeve

The Firefly 109+ Fire Sleeve, (also referred to, herein, as '109+ Fire Sleeve'), is formed from a composite of mineral wool and graphite-based intumescent material; specific details are retained on the IFC confidential file for this report. The composite material is vacuum formed into a tube section, which is either rectilinear, albeit with slightly rounded internal and external corners, or circular; in all cases formed with a 10mm thick annular 'wall'. A metallic foil is applied to the outer surface of the 109+ Fire Sleeve.

All 109+ Fire Sleeves include an additional inner liner of Firefly 107 material, which must not be removed. Sleeves for 54mm deep and 60mm deep rectilinear vents each include a 4mm thick Firefly 107 liner inside one 'long' edge, which must be fitted at the 'top' of the duct; whereas the Sleeve for 90mm deep rectilinear vents includes a 4mm thick 107 liner inside 'top' and 'bottom' edges. Circular Sleeves for 103mm and 127mm diameter ducts include a 4mm thick Firefly 107 liner, whereas the Sleeves for 155mm diameter include an 8mm thick 107 liner; in these cases, around the full perimeter. The Firefly 107 liner increases the overall thickness of the annular wall of the Sleeve by 4mm or 8mm, as applicable.

The particular section size (i.e. overall width/depth, or diameter) of the 109+ Fire Sleeve is formed to suit the section size of each specific vent duct. This report considers 109+ Fire Sleeves that are designed to be used with the following vent duct sizes;

Duct size (mm)	Wall thickness of duct (mm)	Duct Material	Standard Length of 109+ Fire Sleeve
110 x 54	1.5	PVC	180
204 x 60	1.5-1.8	PVC	180
220 x 90	1.8	PVC	180
103 diameter	1.5	PVC	180
127 diameter	1.8	PVC	<b>280</b>
155 diameter	2	PVC	<b>280</b>

**Table 1. Range of Firefly 109+ Fire Sleeves**

The standard length 109+ Fire Sleeves are only designed for applications where partitions are no thicker than 130mm. When installed, the 280mm long 109+ Fire Sleeves, (for 127/155mm diameter vents), must project beyond each face of the partition by at least 75mm; and the 180mm long 109+ Fire Sleeves, (to be used with all other approved vent sizes), must project beyond each face of the partition by at least 25mm. Where partitions are thicker than 130mm, special length 109+ Fire Sleeves can be manufactured by Tenmat, so that the 75mm or 25mm projections, as applicable, are maintained.

See Sections 4.6 and 4.7 of this report for the approved details for installation, and the specifications/limitations applicable to the fire resisting partitions.

## 2.2 Proposed Bespoke Installation details

It is proposed that the 109+ Fire Sleeves may be installed around PVC vent ducts that penetrate through fire resisting partitions that are formed using proprietary steel studs clad with plasterboard. In particular, the following applications are proposed;

- i) Individual 109+ Fire Sleeves may be installed around individual vent ducts which penetrate partitions that are designed to provide 30, 60, 90, or 120 minutes fire resistance, as applicable; on the basis that the partitions will be formed with different facing boards, and/or different studs, to suit the fire rating, and other criteria.
- ii) Two or three rectilinear 109+ Fire Sleeves may be installed around two or three adjacent rectilinear vent ducts, so that the sides of adjacent 109+ Fire Sleeves are in contact with each other; i.e. such that there is no residual 'partition construction' between the adjacent vent ducts/Fire Sleeves. All ducts in such double/triple 'side-by-side' combinations shall be of the same size. This application is proposed for all partitions types/fire ratings considered herein.
- iii) In applications i) and ii), above, the vents are designed to be penetrate the 'body' of the partition; i.e. remote from the perimeter. In addition, it is proposed that rectilinear vent ducts may be installed at the head of the partition, (either individually, or in double/triple combinations, as described in items i and ii above), so that the top edge of the 109+ Fire Sleeve (or Sleeves) interfaces with the underside of a concrete soffit; whilst the other edges of the Sleeve interface with the partition. This proposal does not include applications where the head of the partition includes a "deflection head".

See Sections 4.3 and 4.6 of this report for further details of the approved details for installation of these bespoke applications; and Section 4.7 for the specifications/limitations applicable to the fire resisting partitions.

## 3. TEST EVIDENCE

The results of tests for Firefly 109+ Fire Sleeves are summarised below. The specimens were fitted in a 3m x 3m partition, 100mm thick; comprising 50mm deep steel studs, clad on each face with two layers of 12.5mm thick 'Type F' plasterboard. All ducts were PVC.

Test Reference	Vent duct specifications size/wall thickness (mm)	Length of Fire Sleeve (mm)	Integrity performance (minute)	Insulation performance (minutes)
RF13219	Duct 1: 103mm diameter/1.5mm	150	132*	132*
	Duct 3: 220 x 90mm/1.8mm	150	132*	124
	Duct 4: 204 x 60mm/ 1.5-1.8mm	150	132*	131
	Duct 6: 110 x 54mm/1.5mm	150	132*	132*
	Duct 10: 155mm diameter/2mm	250	132*	131
	Duct 12: 127mm diameter/1.8mm	250	132*	131

**Table 2: Summary of test (to BSEN1366-3) for Firefly 109+ Fire Sleeves**

**Notes-**

- *\*Test terminated without failure of specimen*
- *In accordance with EN1366-3, ends of ducts were not plugged.*
- *All ducts fitted in positive pressure zone of specimen.*

## 4. ANALYSIS

Evaluation of the contribution to fire resistance provided by the proposed Firefly 109+ Fire Sleeves will address the factors that influence their overall fire performance under the fire test conditions of BS476: Part 20: 1987. These include the following factors;

- Properties, size and characteristics of polymeric penetrations
- Properties and characteristics of Firefly 109+ Fire Sleeves
- Intumescent material type and dimensions
- Integrity and insulation performance
- 'Bespoke' applications
- Supporting constructions

The contribution provided by the Firefly 109+ Fire Sleeves will be assessed in respect of the integrity and insulation criteria of BS476: Part 20: 1987, as applicable.

## 4.1 Tested Performance and Characteristics of the Firefly 109+ Fire Sleeves

Analysis of the test evidence has identified the following aspects;

- The Firefly 109+ Fire Sleeve has been successfully tested with a number of PVC vent ducts with different cross-sectional dimensions, when fitted through a plasterboard clad stud partition.
- The 109+ Fire Sleeves were installed in a partition specification designed to provide at least 120 minutes fire resistance, and integrity and insulation was generally maintained at the penetrating ducts for at least 130 minutes, without failure.
- The sectional size of the proposed ducts, and the thickness of the PVC 'wall' of the ducts, is identical to those tested.

## 4.2 Bespoke Variations

### 4.2.1 *Installation in differing partition types*

Test RF13219 demonstrated that 109+ Fire Sleeves perform effectively when installed in a 100mm thick partition, with twin plasterboard layers on each face, for at least 120 minutes. Partitions to provide 60 or 90 minutes fire resistance would normally be at least 100mm thick, and thickness/number of board facings would be similar to that tested, and so the evidence would directly apply to such partitions, for 60 or 90 minute applications.

It is also proposed that the Fire Sleeve may be fitted around ducts penetrating plasterboard clad partitions that only have a single plasterboard layer on each face, and are a minimum of 72mm thick, to provide 30 minutes fire resistance, or a minimum of 100mm thick, to provide 60 minutes fire resistance.

There is no direct test evidence to support this application, and it may be perceived that the variations could adversely affect the degree of support to the 109+ Fire Sleeve, or the efficacy of the Sleeve itself. The following factors support our analysis;

- Whilst a single layer plasterboard on the exposed face of a partition will begin to degrade more quickly under fire test conditions, compared with the twin boards in test RF13219, the proposed applications are only for 30 and 60 minutes, compared to the 130 minutes achieved in the test; providing a level of safety in the design and performance of the 109+ Fire Sleeves.
- Furthermore, since the 109+ Fire Sleeve projects beyond each face of the partition, the Sleeve will maintain an interface within the aperture on the unexposed face, and will thus remain supported by the cantilevered effect; even though the board on the exposed face is degrading.

- Use in a 72mm thick partition means that there will be less 109+ Fire Sleeve 'within' the partition, compared with that tested. Supplementary evidence is available for the original 109 Fire Sleeve, which was tested in a 60mm thick Batt. This test, not summarised herein, demonstrated that the reduction in 'wall thickness', and the resultant increase in projection, did not prevent the overall assembly satisfying the integrity criteria for more than 60 minutes. Analysis by IFC has compared the original 109 and new 109+ Fire Sleeves, and it is our opinion that use of the 109+ version in 72mm thick partitions will be acceptable for 30 minutes, as proposed.

It is thus our analysis that the 109+ Fire Sleeves will still be able to maintain their sealing function for 30 or 60 minutes, as applicable, when fitted to individual ducts through 72mm thick or 100mm thick partitions, respectively, with single layer boards on each face. It is also our analysis that the 109+ Fire Sleeves will still be able to maintain their sealing function for 60 or 90 minutes, as applicable, when fitted to individual ducts through 100mm thick partitions, with double layer boards on each face. In all cases, subject to inclusion of the measures discussed in Sections 4.3, 4.6, and 4.7 below.

#### **4.2.2 Installation in 'side-by-side' combinations**

It is proposed that the 109+ Fire Sleeves may be used in a side-by-side arrangement, which has not been tested. This means that the sides of adjacent Fire Sleeves will be abutting each other, as opposed to being in contact with the partition.

It may be perceived that the sides of the 109+ Fire Sleeve need to be in direct contact with the aperture in the partition, in order to 'contain' the activation of the intumescent lining, and ensure that it expands inwards; to crush the softening vent duct as it collapses due to the extreme heat within the test furnace. However, analysis of the test results, and of the characteristics of the 109+ Fire Sleeve, demonstrates that the foil outer layer of the 109+ Fire Sleeve, and the mineral composite, is sufficiently robust to ensure that the active ingredients expand inwards, and seal the duct.

It is thus our analysis that the installation of two or three 109+ Fire Sleeves in a side-by-side arrangement will not adversely affect the expansion characteristics of the Sleeves, which will still be able to maintain their sealing function; subject to inclusion of the measures discussed in Sections 4.3, 4.6 and 4.7, below.

#### **4.2.3 Installation against a concrete soffit**

It is proposed that the 109+ Fire Sleeves may be fitted directly under a concrete soffit; a configuration which has not been tested. Depending upon the alignment of the vent duct, relative to the soffit, it may be necessary to compress the top edge of the Fire Sleeve by 5mm; reducing the standard 15mm thick annular wall to 10mm thickness.

The following mitigating factors are considered as part of our analysis;

- The specimens achieved up to a 10% over-run, providing a level of safety in the design and performance of the 109+ Fire Sleeves. In addition, Test RF13219 was performed against the furnace conditions of EN1366-3 2009, which is accepted as being more onerous than those in BS 476 Part 22 1987; introducing a further degree of safety.
- The ducts will be installed at the top of the partition, which is fixed back to the concrete soffit, and so the level of lateral movement exhibited by the partition, relative to the penetration, would be less than if the ducts were installed through the 'body' of the partition, as tested; creating a more robust scenario.
- Penetrations through the 'body' of the partition will be surrounded by plasterboard on all four edges, which will be prone to shrinkage as the board dehydrates under heating; creating propensity for lack of fixity, and sealing. However, the concrete soffit will not shrink in this way; and so the 109+ Fire Sleeve is more likely to remain securely in place in this proposed application.
- Compression of the annular wall, by 5mm, to fit the Fire Sleeve between the duct and the soffit, will not adversely affect its ability to react/expand; since the quantity and proportion of 'active ingredient' will not be modified.

Based upon these factors, it is the opinion of IFC that the 109+ Fire Sleeves would maintain the proposed levels of fire resistance if fitted with their upper surface against the concrete soffit; subject to inclusion of the measures discussed in Sections 4.3, 4.6 and 4.7, below. This approval does not include applications where the head of the partition includes a "deflection head". Such applications should be subject of separate review/approvals.

### **4.3 Length of Firefly 109+ Fire Sleeves**

The 127mm and 155mm diameter ducts in test RF13219 were each fitted with a 250mm long 109+ Fire Sleeve, which projected 75mm beyond each face of the 100mm thick partition. The other specimens in test RF13219 included 150mm long Firefly 109+ Fire Sleeves; projecting 25mm beyond each face. Although the test was terminated without integrity failure after 132 minutes, there is no evidence to demonstrate whether the length of the 109+ Fire Sleeve can be less than that tested, and/or whether the degree of projection of the 109+ Fire Sleeve can be less than tested; without adversely affecting the integrity performance.

If a partition thickness of 100-130mm is required, for other criteria, and irrespective of the fire rating, (see Note 2 in Section 4.7), then the length of the 109+ Fire Sleeve will also need to be increased - beyond the 150mm length or 250mm length, as applicable, used in testing – to maintain the required projection of 25mm or 75mm, as applicable.

If the 109+ Fire Sleeves are to be installed in partitions thicker than 130mm, irrespective of the fire rating, then bespoke 'special length' 109+ Sleeves must be manufactured by Tenmat, to maintain the required projection of 25mm or 75mm, as applicable, beyond both faces of the partition.

Analysis in Section 4.2.1 herein results in IFC's opinion that the 109+ Fire Sleeves can be used in partitions thinner than 100mm, where a 30 minute fire resistance is required. Where the partition is less than 100mm thick, the length of Sleeve 'within' the fire resisting barrier will be reduced, (compared with that tested), but the length of 109+ Fire Sleeve shall remain as tested; such that the relative degree of projection will be increased. For example, using a 109+ Fire Sleeve in a 72mm thick partition, for 30 minutes fire resistance, would result in a 38mm projection on each face for a 150mm long Sleeve, or an 88mm projection on each face for a 250mm long Sleeve.

In all cases, the length of 109+ Fire Sleeve, as defined herein, must be installed as a single piece, to suit the partition thickness and the prescribed projection. The length of the 109+ Sleeve must **not** be created by butt-jointing shorter pieces of 109+ Fire Sleeve.

#### **4.4 Specification for the Firefly 109+ Fire Sleeve**

Tenmat Ltd has stated that there are no changes to the intumescent material, or the mineral wool, that are used in the composite material forming the annular wall of the 109+ Fire Sleeves; compared with that tests summarised in Section 3 herein. The proportional mix of the two materials is also as tested. The tests have demonstrated that the wall thickness of the 109+ Fire Sleeve can remain at 10mm, with any of the proposed vent duct sizes. The formulation of the Firefly 107 liner is also all as tested.

#### **4.5 Insulation Performance of the Firefly 109+ Fire Sleeves**

All of the 109+ Fire Sleeves tested on PVC ducts satisfied the insulation criteria for the same period as that for integrity; or at least for the respective 'target' figure of 120 minutes. A corollary of this is that the insulation rating of the 109+ Fire Sleeves will match the integrity rating approved, herein; subject to a minimum partition thickness/specification for the appropriate period. See also Section 4.7 below, regarding essential specifications for partitions.

#### **4.6 Installation of the Firefly 109+ Fire Sleeve**

- Firefly 109+ Vent Duct Fire Sleeves shall be fixed closely around the PVC duct, and the longitudinal joint in the Sleeve shall be closely fitting and sealed with metallic tape. The 109+ Fire Sleeve shall be carefully aligned and secured in place whilst the plasterboard is 'offered up' into position around the 109+ Fire Sleeve.
- The 127mm and 155mm diameter ducts shall be fitted with a 109+ Fire Sleeve that is at least 250mm long, and projects by at least 75mm beyond each face of the partition.

- The other sizes/shapes of ducts shall be fitted with a Firefly 109+ Fire Sleeve that is at least 150mm long, and projects at least 25mm beyond each face of the partition.
- Each aperture for the 109+ Fire Sleeve shall be at least 50mm away from the steel studs within the partition. There shall be at least 200mm between each aperture.
- Ideally, the hole through the plasterboard should be carefully cut to suit the outer dimensions and profile of the 109+ Fire Sleeve, without any gaps between the 109+ Fire Sleeve and the edge of the hole. If this is the case, then no additional protection is needed.
- Any gaps between the 109+ Fire Sleeve and the aperture, resulting from inaccurate cutting and site tolerances, but only up to a maximum of 5mm in width, shall be sealed with a proven intumescent acrylic sealant. The sealant shall be applied as a generous 'bead', around the circumference of the 109+ Fire Sleeve, so that it overlaps the face of the 109+ Fire Sleeve where it enters and exits the partition.
- The intumescent acrylic sealant, referenced above, shall be of a type that has suitable fire resistance test evidence for the rating and application concerned.
- All vent ducts, to which the proposed 109+ Fire Sleeves are fitted, shall be adequately and independently supported by, and fixed to, supports within 300mm of the partition, on both faces of the partition; using a support system that will remain effective under fire test conditions.
- Where rectilinear 109+ Fire Sleeves are fitted against the underside of the soffit, the top of the 109+ Fire Sleeve should be in close contact with the soffit. Alternatively, if the duct is already fitted closely to the soffit, the 15mm thick annular wall of the top of the 109+ Fire Sleeve may be compressed to a minimum 10mm thickness.
- If the rectilinear 109+ Fire Sleeve is in close and constant contact with the soffit, no additional protection is needed in this zone. Alternatively, if the Sleeve is not in constant and close contact with the soffit, any gaps between the upper surface of the 109+ Fire Sleeve, up to a maximum of 5mm, should be sealed with intumescent acrylic sealant; applied as two beads of sealant, one on each face, to the upper surface of the 109+ Fire Sleeve, and aligned with the outer faces of the partition. Tolerances and sealing of gaps between the other edges of the 109+ Fire Sleeve and the plasterboard, over the lower zone of the penetration, shall be as described, above, for individual 109+ Fire Sleeves.
- Where rectilinear 109+ Fire Sleeves are installed side-by-side, the adjacent sides of each Sleeve must be in close and constant contact with each other. Tolerances and sealing of gaps between the other edges of the 109+ Fire Sleeves and the plasterboard/ concrete, shall be as described, above, for individual 109+ Fire Sleeves.
- Although the concept of triple combinations is approved herein, direct approval by IFC is, effectively, limited to use with 3no 110mm wide rectilinear ducts, which will fit between standard studs at 600mm centres. Use of 3no 204mm or 3no 220mm wide ducts in a side-by-side combination will necessitate modifications to the studs, and will be subject to additional approval, by others. See Note 3 in Section 4.7.
- Refer to Section 4.7, herein, regarding all installations against the soffit.
- In all cases, the length of 109+ Fire Sleeve must be installed as a single piece. The length must **not** be created by butt-jointing shorter pieces of 109+ Fire Sleeve.
- The PVC vent duct shall be continuous where it passes through the 109+ Fire Sleeve. Joints in the vent duct shall be remote from the 109+ Fire Sleeve.

## 4.7 Supporting Construction

This approval applies to situations where 109+ Fire Sleeves are fitted around PVC vent ducts penetrating fire resisting partitions formed from proprietary steel studs clad with plasterboard; and, in some cases, which abut the underside of a concrete soffit. All supporting constructions must have suitable supporting documentation to demonstrate up to 120 minutes fire resistance, as applicable, in accordance with BS476: Part 22: 1987.

### 4.7.1 *Minimum specifications for partitions*

The partition specifications have an influence upon the length, alignment, and support of the Fire Sleeve, and so the following minimum specifications must be adopted;

- Fire resisting partitions required to achieve 30 minutes fire resistance shall comprise minimum 47mm deep studs, clad with at least 1no layer of 12.5mm thick plasterboard on each face. Minimum partition thickness shall be 72mm. *Note 2*.
- Fire resisting partitions required to achieve 60 minutes fire resistance shall comprise minimum 47mm deep studs, clad with at least 2no layers of 12.5mm thick plasterboard on each face, or at least 1no. layer of 15mm thick plasterboard, on each face. Minimum partition thickness shall be 100mm. *Note 2*.
- Fire resisting partitions required to achieve 90 or 120 minutes fire resistance shall comprise minimum 47mm deep studs, clad with at least 2no layers of 15mm thick plasterboard on each face. Minimum partition thickness shall be 107mm. *Note 2*.

*Note 2* The minimum specifications for partition constructions quoted herein relate to their thermal characteristics, with regard to the contribution towards the performance of the 109+ Fire Sleeve. It is the responsibility of others to determine the thickness and specification of the construction for other criteria, under cold-state and fire hazard conditions, which may be greater than the minimum requirements defined herein.

### 4.7.2 *Influence upon the partition, with 109+ Fire Sleeves against the soffit*

The analysis thus far has considered the performance, under fire resistance testing, provided by the 109+ Fire Sleeves, and the relative contribution towards this performance provided by the supporting construction. However, the performance of the partition itself, under fire resistance testing, must also be considered; especially with bespoke arrangements, where the ducts are installed against the underside of the soffit.

In this configuration, the head track of the partition, and the facing boards, need to be 'cut away' locally to the penetration, but it must be ensured that the arrangement does not adversely affect the integrity of the partition, local to the penetration.

The following analysis supports the proposal;

- The specification for tested partition systems usually defines that screw fixings at the board perimeter should be at maximum 300mm centres. Supplementary fire test evidence is available, not summarised herein, for the original 109 Fire Sleeve, where an individual 109 Fire Sleeve was installed against the soffit; interrupting the head track. In this test, only one screw was 'omitted' at the head track, on each face - due to the centrally positioned duct; so that there were no other screws at the head, apart from those at the outer corners of each board, aligned with the studs. This modification did not adversely affect the ability of the overall specimen to achieve at least 120 minutes integrity; and the evidence can be applied to individual 109+ Fire Sleeves that are fitted against the soffit.
- Where double or triple combinations of 'side-by-side' 109+ Fire Sleeves, as considered herein, are positioned under the soffit, the degree of interruption to the head track will be greater than with an individual Sleeve, but it will not omit any more screws, or increase the span of 'unsupported' plasterboard. On this basis, it will be no more onerous than when tested with the 109 Fire Sleeve.
- This is, of course, subject to the degree of fixity between the studs and the head track, and between the head track and soffit, being otherwise all as tested/approved for the relevant partition system.

The following conditions and limitations apply when fitting 109+ Fire Sleeves against the soffit;

- The aperture for the 109+ Fire Sleeve must be at least 50mm away from any stud, and there shall be at least 200mm of partition between each aperture.
- Within the scope of this generic approval by IFC, 109+ Fire Sleeves will be positioned within each 'bay' formed by the steel studs of the partition, which are generally at maximum 600mm centres; see also Note 3, below.
- The 600mm bay width limits the options where side-by-side Sleeves are fitted, since the combined width of side-by-side Sleeves shall not form an interruption to the head track of more than 500mm - e.g. only 2no. 220mm wide ducts, or 2no. 204mm wide ducts, or up to 3no. 110mm wide ducts may be fitted; in all cases plus the thickness of the 109+ Fire Sleeves. See also Note 3, below.
- Such arrangements must ensure that the stud centres, the degree of fixity between the studs and the head track, and between the head track and soffit, will remain as tested/approved for the relevant partition system. See also Note 3, below.
- If the combined width of side-by-side penetrations needs an interruption to the head track of more than 500mm - e.g. 3no. 220mm or 204mm wide ducts (plus 109+ Fire Sleeves) - then these would not fit within a 600mm wide bay, and the stud/head track will need to be suitably modified to ensure adequate fixity; see Note 3 below.
- In situations where the alignment of ducts clashes with the stud locations, even if the interruption is less than 510mm wide, then the stud/head track will need to be suitably modified to ensure adequate fixity; see Note 3 below.

Note 3 *Within this generic approval for 109+ Fire Sleeves, it is inappropriate for IFC to consider the possible modifications that may be deemed suitable to accommodate significant interruptions to head track or studs; bearing in mind the numerous partition systems that are available, and the various applications which may arise. It is thus the responsibility of others to determine the suitability of the partition to accept such modifications, and to ensure that all other aspects of the partition comply with the test evidence/third party approvals for the specific design employed.*

*In such scenarios, it is recommended that a project specific appraisal is commissioned, prior to commencing construction, since bespoke modifications and/or upgrades to the partition may be necessary to provide a robust solution that can be positively assessed.*

## 5. CONCLUSION

It is the opinion of International Fire Consultants Ltd that, if the Firefly 109+ Fire Sleeves were fitted around PVC Vent Ducts, as specified in this report, and were installed in a supporting construction which will maintain integrity and insulation for the required period of fire resistance performance, then the proposed Firefly 109+ Fire Sleeves would maintain integrity and insulation of the element, at the location of the penetration, if a representative specimen of the partition were to be tested to the integrity and insulation criteria of BS476: Part 20: 1987 for up to 120 minutes, as applicable.

## 6. LIMITATIONS

This Assessment Report addresses itself solely to the ability of the assemblies described to satisfy the criteria of the fire resistance test. It does not imply any suitability for use with respect to other unspecified criteria.

This document assumes that the surrounding construction will provide no less restraint than in the tested assembly, and that it will remain in place and be substantially intact for the full fire resistance period.

Where the constructional information in this report is taken from details provided to International Fire Consultants Ltd (IFC) and/or from fire resistance test reports referenced herein, it is, therefore, limited to the information given in those documents. It is necessarily dependent upon the accuracy and completeness of that information. Where constructional or manufacturing details are not specified, or discussed herein, it should not, therefore, be taken to infer approval of variation in such details from those tested or otherwise approved.

The assessed constructions have not been subject to an on-site audit by International Fire Consultants Ltd, and it is the responsibility of anyone using this report to confirm that all aspects of the assemblies fully comply with the descriptions and limitations herein.

Any materials specified in this report have been selected and judged primarily on their fire performance. IFC do not claim expertise in areas other than fire safety. Whilst observing all possible care in the specification of solutions, we would draw the reader's attention to the fact that during the construction and procurement process, the materials used should be subjected to more general examination regarding the wider Health and Safety, and CoSHH Regulations.

This Report is provided to the sponsor on the basis that it is a professional independent engineering opinion as to what the fire performance of the construction/system would be should it be tested to the named standard. It is IFC's experience that such an opinion is normally acceptable in support of an application for building approvals, certainly throughout the UK and in many parts of Europe and the rest of the world.

However, unless IFC have been commissioned to liaise with the Authorities that have jurisdiction for the building in question for the purpose of obtaining the necessary approvals, IFC cannot assure that the document will satisfy the requirements of the particular building regulations for any building being constructed.

It is, therefore, the responsibility of the sponsor to establish whether this evidence is appropriate for the application for which it is being supplied and IFC cannot take responsibility for any costs incurred as a result of any rejection of the document for reasons outside of our control. Early submittal of the Report to the Authorities will minimise any risks in this respect.

All penetration seal devices are to be fitted and installed strictly in accordance with the manufacturer's current installation instructions, and the conditions of approval in this report. In the event of any discrepancies between the instructions and this report, IFC should be consulted for clarification.

The analysis and conclusions within this report are based upon the likely contribution to fire resisting performance provided by a penetration sealing device that is manufactured and installed in accordance with this document, and offered for fire resistance testing in 'perfect' condition. In practice, management procedures must be in place in any building where the proposed devices are installed, to ensure that no parts of the devices are damaged or faulty; and indeed that the adjacent supporting construction is in good condition. Any such shortfalls in respect to the condition and/or installation of the devices, and structure, will invalidate the approval by IFC, and may seriously affect the ability of the assembly to maintain the required level of fire resistance performance. Determination of what constitutes damage, and any corrective actions in order to return devices to the required condition, should only be carried out following consultation with the manufacturer and IFC.

## 7. VALIDITY

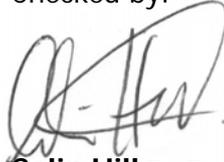
This assessment has been prepared based on International Fire Consultants Ltd's present knowledge of the products described, the stated testing regime and the submitted test evidence. For this reason anyone using this document after January 2020 should confirm its ongoing validity.

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