THE BESA BOOK 2021

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BUILDING ENGINEERING SERVICES ASSOCIATION

A Client's Guide to Building Engineering Services

PERFORMING SEALS

As industry luminaries pool their expertise in a comprehensive best practice guide on firestopping service penetrations, Firesafe Fire Rated Ductwork technical manager and ASFP TG6 chair, Darren Webster, calls for serious consideration of the role of support systems.

Preserving the passive fire protection seals surrounding building services are proven through comprehensive testing to prevent the spread of fire through a fire-separating element.

Compartmentation is the term used to describe the process of dividing up a building into smaller, defined spaces. So, if a fire breaks out in any part of the building, it does not spread beyond that secure compartment because it is contained by the fire resisting walls and floors that form it. The period of protection required depends upon the use of the building space. This can vary from 30 minutes to four hours.

All services that necessarily penetrate these fire separating elements must incorporate a fire penetration seal to reinstate the fire resisting element and ensure that the compartmentation is not compromised.

Jointly, the Association for Specialist Fire Protection; BESA; Building Services Research and Information Association; Finishes and Interior Sector and Gypsum Products Development Association have recently published a comprehensive best practice guidance document entitled *'Fire Stopping of Service Penetrations – Best Practice in Design and Installation.'*

This multi-agency approach provides authoritative guidance on the correct methods to be used and also the regulations in place to help ensure adherence to this guidance. It is the go-to publication for anyone involved with, or who has a responsibility for, providing a safe, compliant building.

Given my day-to-day role, I have long felt that an area which requires much greater emphasis is this adequate support of all building services and, just as important, proper consideration how the myriad of cable and pipe services passing through walls and floors may impact the performances of passive fire resisting products.

Of course, all penetration seal types are comprehensively tested to demonstrate their suitability and account for many variables (such as size, service carried, fire resistance period and proximity to other services) to ensure correct selection and installation. It is critical, however, to ensure that services and their conduits are provided with adequate support, especially locally to the fire separating element.

As can be seen, the test rig provides comprehensive support of the services either side of the fire separating element. The samples to be fire tested are generally short in length to ensure that the arrangement is not subjected to the excessive weight strain. It is therefore critical that the equivalent level of support is replicated during installation in a building. If inadequate supports or excessive expansion of those supports exerts undue forces on the penetration seal, there is only one likely outcome – the premature failure of the seal. >>

Fire resisting ductwork (FRD) is a passive fire protection specialism which I live and breathe. All my experience tells me that it is a special case. In that its penetration seal should be completely independent from all other service penetrations. There is a European Standard in development which would allow a combination of FRD (or indeed fire dampers) and other services within one penetration.

Achieving full convergence from so many stakeholders may take some time. So, until this Standard is agreed and ratified, FRD should not be installed along with any other services within a single opening. Unfortunately, whether to save time, money or just through sheer ignorance, we all know that 'best practice' is not always 'normal practice'. This short-term thinking shows scant regard for the potential cost of a failed system... in terms of life, let alone finance.

One of the unique conditions regarding FRD is that it not only penetrates the boundaries but continues throughout the building and penetrates multiple compartments. Therefore, support is not only critical at the penetration points but also along its entire routing.

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If supports fail, it will naturally lead to the ductwork collapsing. This is likely to lead to a premature failure of the fire separating element, thus allowing fire to swiftly move from one compartment to another.

To prevent this, the supports need to be designed within strict structural limits. The normal strength of steel is defined by its 'tensile stress', with a typical ambient strength of 250N/sq mm. Fire resisting supports need to be designed so that they are within a maximum limit of 9N/sq mm for up to 60 minutes resistance or a maximum 6N/sq mm for up to 120 minutes resistance.

Consideration should also be given to the type of fixings employed. They must be fire resistant in order to take the combined given load of the supports and ductwork under fire conditions. This is the reason that supports for FRD appear so heavily engineered in comparison to supports for standard ductwork.

The carefully calculated weight of the ductwork (and insulation if required) defines the sizes of these supports. There is no spare capacity to add further weight and still stay within the design limits. The unequivocal rule is that no other services can be hung from them; they must be independent from other supporting services.

The method and arrangements for designing FRD support systems is no different from a standard ductwork detail but must be within the limits previously stated. Trapeze-type, cantilever and spanning steels are among the most common methods but the steel sections can often increase to 100 by 50 by 10mm PFC (parallel flange channel) with M20 drop rods – and even heavier duty – to comply with the stress limits. Permissible maximum distance between each support is also markedly reduced compared with standard, non-fire rated ductwork designs.

The design process itself is relatively simple. Often the key issue identified on a site survey is how and where to fix the supports to the building structure so to avoid other services having an adverse impact on them.

It is unfortunately all too common that services are installed directly above an FRD route. In a prolonged fire, it is entirely possible that services support systems will fail and / or through excessive expansion fall onto the ductwork below. This added weight could easily exceed the design stress limits of the FRD support system (including its fixings) and cause its premature failure. >>

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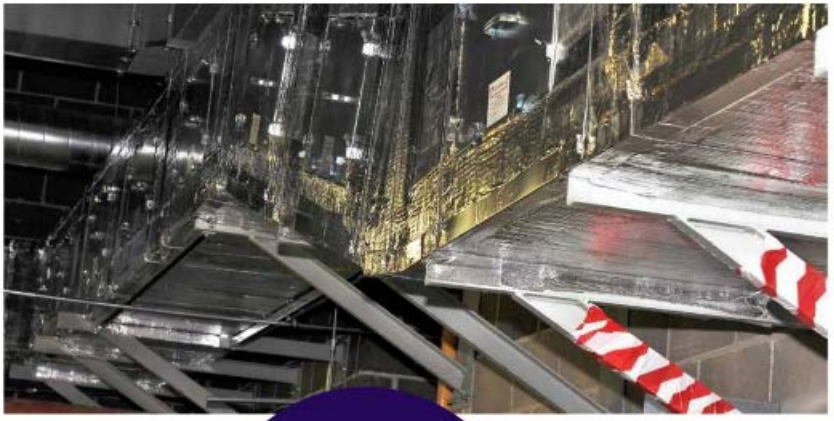

The type of fixing is equally important. They need to be selected from those that have a proven fire resisting performance. The two key considerations are the type of structure available to which they will be fixed, and the period of fire resistance required.

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Clearly, the performance of the fire resisting supports will only be as good as the structure to which they are fixed. Often, risers are constructed specifically to house the ductwork; however, as these are usually built from lightweight boarding materials, they are unlikely to be suitable as anchor points. They may be classified as fire resisting in their own performance but have no structural strength to allow the duct to be supported from it.

Another common issue concerns systems within a plantroom at roof level where the only structure to which to fix is the roof itself; and this generally does not have a rated fire performance. An FRD system must be fixed to a fire-resistant structure to ensure it remains in place for the full period of performance for which it is designed. Incorrect design of the structure may lead to spalling during the fire, endangering fire-fighters and, ultimately, leading to failure of the services connected to it.

Early engagement is essential so that all services have designed penetration seals, supports and fixings agreed and specified during the earliest possible design stage of a building. This ensures that sufficient space is allowed to construct these, and the correct installation sequence is programmed to facilitate inspection during this process. This is needed to verify – and, ideally, third-party certify – that each element is correctly installed. Only then will we achieve a truly 'designed and built' building that not should but will provide the proper level of protection for people and property that we may reasonably expect.

Ever since the Grenfell tragedy, heightened awareness of the importance of fire performance has been driven to the top of the agenda. Given my two 'hats', I would say that it's always been top of my agenda.

The hoped-for denouement of the Hackitt Report is that everyone will raise their game. That is good news. The real issue is that consideration of the methods of installation and anticipated performance of ductwork in a fire is still misunderstood by many. It is our unswerving mission to inform, educate and raise the collective bar. ■

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