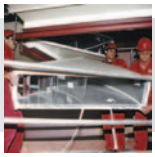

Graham Ellicott
Association for Specialist Fire Protection

Fire rated ductwork and fire dampers

Fire Protection Limited (ASFP member)

1 Types of product

In commercial buildings, compartment walls and floors will have a prescribed fire-resistance period, which means that the performance criteria of load-bearing capacity (stability), integrity and insulation have been met for durations of between 30 and 240 minutes. It is therefore vitally important that where compartmentation boundaries are penetrated by building services, the fire separation and the performance criteria for the penetrated wall or floor are maintained and, in particular, that all forms of ducting in a building do not become a conduit along which a fire may spread to other areas.

The fire performance of a duct which penetrates a fire-resisting/separating element requires careful consideration by specifiers and controlling authorities.

The standard periods of stability and integrity should in all cases be at least equal to those required for the penetrated element.

The guidance given in Approved Document B1 (Means of Escape) and B3 (Internal Fire Spread Structure) of the Building Regulations 2000 for England and Wales refers to BS 5588: Part 9: 1999: *Fire precautions in the design, construction and use of buildings. Code of practice for ventilation and air conditioning ductwork* for alternative ways in which the integrity of compartments may be maintained, where ventilation and air conditioning ductwork penetrate fire separating elements. Similar recommendations are given in the Northern Ireland Building Regulations and in the Building Standards (Scotland) Regulations.

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2 Types of system

a) Fire dampers

A fire damper is a device which is installed at the point where the duct penetrates the compartment wall or floor. The fire damper allows the ventilated air in normal conditions to pass through a duct, wall or partition. In a fire situation, the damper closes automatically to prevent the passage of fire for a stipulated time period.

Closing mechanisms take the form of a fusible link, which fractures at a certain temperature to release a closing mechanism; or intumescent coated matrices, which intumesce under fire conditions to close the gaps in the matrix.

Fire dampers are designed to be installed in line with the cavity barrier, fire wall or compartment wall/floor through which the ductwork passes. If they are not in line with the fire division, then fire can bypass the system. The fire damper assembly should be independently supported so that failure of the duct will not cause failure/collapse or disturbance of the damper mechanism in the line of the wall.

Ducts need to be adequately supported so that no undue load is applied to the fire damper. This can result in distortion of the duct, which in turn may prevent the fire damper from closing properly, or not at all. It is imperative that the fire damper is tested (or assessed) for the particular type of wall or floor in which it is to be installed.

b) Self-supporting fire-resisting enclosures

Fire-resisting enclosures are constructed without a steel lining duct, using self-supporting board and casing systems made from calcium silicate and cement-based products. These materials provide fire protection in two ways; by cooling, which involves trapping moisture (physically and chemically bound) as it evaporates with the rising temperature; and once all the moisture has turned to steam, the product then behaves as a thermal insulation material.

Board systems for self-supporting fire-resisting enclosures may have different fixing systems for different ratings and the inspector should make sure that the appropriate one is being used. In particular, all fixings, hangers or stiffeners should be of the correct grade of material and installed at the appropriate centres. Adhesives will also be required; the type may vary according to the pressure design of the enclosure.

c) Fire-resistant ductwork

Fire-resisting ventilation or extraction steel ductwork is designed using proprietary materials and fixing techniques, to contain fire and the products of combustion in a manner that does not allow passage from the compartment of origin to other parts of the building for a stipulated time period.

Steel ductwork systems for air movements around buildings are generally constructed to the Heating and Ventilating Contractors' Association guide DW/144 (formerly 142), *Specification for Sheet Metal Ductwork*. The guide covers a wide range of construction standards in the manufacture of sheet metal ductwork for use in low, medium or high pressure applications and includes various methods of jointing, stiffening and supporting the ductwork.

BS 5588: Part 9, paragraph 7.5.1 acknowledges that steel ductwork 'if satisfactorily constructed and supported will be able to provide a high degree of resistance to the passage of smoke and decomposition products. However, rapid transfer of heat through the steel, regardless of its thickness, prevents the ductwork achieving any degree of fire resistance without supplementary insulation'.

A satisfactorily constructed and supported steel duct is one proven by test and/or assessment to BS 476: Part 24: 1987: *Fire tests on building materials and structures. Method for determination of the fire resistance of ventilation ducts.* The inspector should make sure that the fire-resistant duct to be installed on site conforms to the requirements of its supporting fire test and assessment documents.

3 Design and installation issues

The use of any fire protection product can be undermined by poor installation. Any work that is not of the correct quality could lead to the premature collapse of a building in a fire situation. It is imperative that qualified contractors are employed, who will install passive fire protection products for steel fully in accordance with the manufacturers' instructions.

Third-party accreditation schemes are in operation for installers of passive fire protection. Such schemes ensure that the contractors and their operatives have the required level of expertise to carry out the job properly. Third-party accredited installation is recognised in Approved Document B, which states, 'Since the performance of a system, product, component or structure is dependent upon satisfactory site installation, testing and maintenance, independent schemes of certification and registration of installers and maintenance firms of such will provide confidence in the appropriate standard of workmanship being provided. Third-party accreditation and registration of installers of systems, materials, products or structures provide a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing the reliability of the anticipated performance in fire.'

Where a product/system has not been fire tested at all, or has test data that is not appropriate to the job in hand (for example, where it is not possible to subject a construction or product to a fire test because of its size, or where the test data applies to a similar, but not identical, system) an assessment will need to be carried out by a competent fire engineer. In such situations, it is best to consult the *Guide to Undertaking Assessments in Lieu of Fire Test,* published by the Passive Fire Protection Federation. The guide is available from website: *www.asfp.org.uk,* or tel: +44 (0)1252 739 142. It breaks assessments into three levels of complexity, discusses the requirements of assessors and identifies four levels of experience. These levels are then related to the complexity of the required assessment.

4 Maintenance

Building managers will need to be aware of the Fire Precautions (Workplace) Regulations 1997 (as amended) and the ramifications of the impending Regulatory Reform (Fire Safety) Order (RRO). The provision and maintenance of the fire-rated ductwork and fire dampers within the building should form part of the risk assessment carried out under the Workplace Regulations (and in future the RRO) for the building. Managers need to be aware that there may be liability issues in the failure to comply with regulations.

Where fire-resistant ductwork and fire dampers need to be removed, have become damaged, or need to be replaced, they must be made good as soon as possible. Ideally, where the operation and maintenance data for a building is available and the 'as-built' products can readily be procured, any changes and repairs should be carried out with the materials originally specified.

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5 Relevant standards and other documents

The design of fire-resisting ductwork of all types (steel or self-supporting board systems) is described in BS 5588: Part 9: 1999: *Fire precautions in the design, construction and use of buildings. Code of practice for ventilation and air conditioning ductwork,* which requires the duct and materials to be tested according to the requirements of BS 476: Part 24: 1987: *Fire tests on building materials and structures. Method for determination of the fire resistance of ventilation ducts.* BS EN 1366-1: 1999: *Fire resistance test for service installations. Ducts,* will eventually replace this test standard, once the EN fire test standards become available.

Ad hoc tests to the requirements of BS 476: Part 20: 1987: *Fire tests on building materials and structures. Methods for determination of the fire resistance of elements of construction (general principles)* are often quoted for fire dampers. BS EN 1366-2: 1999: *Fire resistance tests for service installations. Fire dampers,* will eventually replace these *ad hoc* tests as the EN fire test standards become available.

The Association for Specialist Fire Protection publishes *Fire Rated and Smoke Outlet Ductwork.* Known as the 'Blue Book' it is recognised as the industry guide. It is available from website: *www.asfp.org.uk,* or tel: +44 (0)1252 739 142.

Published by *Fire Prevention & Fire Engineers Journal*
Bastille Court, 2 Paris Garden, London SE1 8ND