Promat

PROMAPAINT® DC1

Ablative fire resistant coating for steel HVAC ducts

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etex building performance

The relative complexity of any ductwork system passing through different fire compartments and the relevance of the system's function in ambient as well as fire conditions can make the selection of a suitable ductwork system difficult.

Ducts meant for the continuous conveying of air or smoke passing through a fire resistant element punctures the compartmentation function of the element. Fire dampers cannot be employed as the ducts need to function as a unobstructed conveyor of air and smoke during a fire. In such situations, a fire resistance duct is the answer.

Likewise unprotected steel smoke extraction ducts deforms in fire negating its capacity to exhaust smoke. Smoke extractions ducts tested to BS 476:Part 24 must maintain 75% of its cross sectional area in order to fulfil the requirement of a smoke extraction duct.

This document aims to give some guidance on the fire performance requirements of ducts and the protection of ducts using PROMAPAINT® DC1.

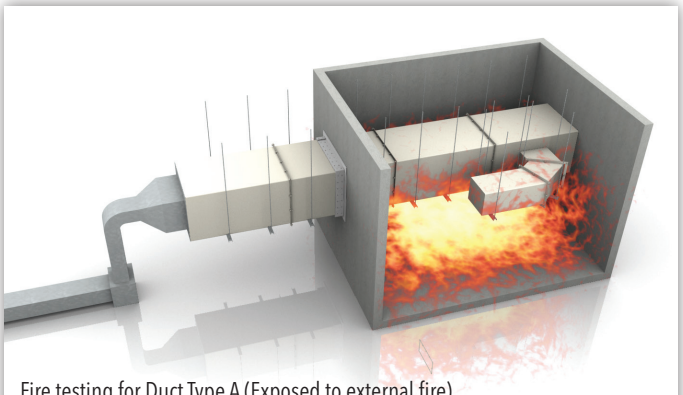
Fire Testing Methods

To determine the fire resistance of ducts passing through or between compartments, the system should normally be tested or assessed in accordance with BS 476: Part 24: 1987 or AS 1530: Part 4: 2005 or BS EN 1366: Parts 1, 8 and 9.

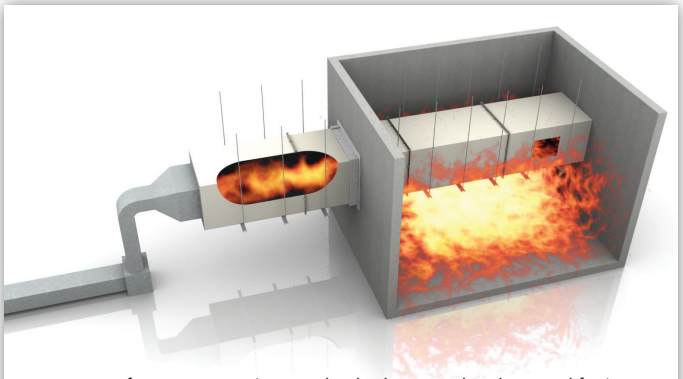
These standards have been written specifically for fire performance testing of ventilation eg. fresh air duct, exhaust air duct and for smoke extraction ducts.

The following information refers to BS 476: Parts 20 and 24. As part of a standard fire test, duct systems are exposed to external fire (also known as Duct Type A) and another duct subject to both external & internal fire (also known as Duct Type B). Fans attached create a standard pressure difference and air flow and the duct s fire performance is assessed in both fan-on and fan-off situations. When testing horizontal ducts, a run of at least 3000mm is located within the test furnace. EN 1366 standards requires a 4000mm length within the furnace and 2500mm outside the furnace on the unexposed face of the specimen.

BS 476: Part 24 expresses the fire resistance of ducts, in terms of stability, integrity and insulation.



Fire testing for Duct Type A (Exposed to external fire)



Fire testing for Duct Type B (Exposed to both external and internal fire)

Stability failure occurs when the suspension or fixing devices can no longer retain a duct in its intended position or when sections of the duct collapse. This requirement does not apply to the length of the duct exposed to internal and external fire (Duct Type B) within the furnace.

It should be noted that if a duct suffers extensive deformation, such that it can no longer fulfil its intended purpose, this would be classed as stability failure. For Duct Type A, loss of pressure within the duct during testing is also construed as stability failure.

Integrity failure occurs when cracks, holes or openings occur in the duct or at any penetrations within walls or floors, through which flames or hot gases can pass. The effects on integrity of the movement and distortion of both restrained and unrestrained ducts are also included in the standard.

Insulation failure occurs when the temperature rise on the outer surface of the duct outside the furnace exceeds 140°C (mean) or 180°C (maximum). Annex A the non-mandatory section of the standard states that ducts lined with combustible materials or coated internally with fats or greases, e.g. kitchen extract, should also have this criterion for the inner surface of the duct within the furnace when the duct is exposed to external fire (Duct Type A).

General Design Considerations

The following points are some of the factors which should be considered when determining the correct specification to ensure a ductwork system will provide the required fire performance.

Required Fire Exposure

Ductwork systems which are located in more than one compartment should always be tested or assessed for their performance when exposed to the heating conditions described within BS 476: Part 20: 1987. Reduced heating curves are generally only acceptable for certain of the systems components, e.g. the fan.

The performance of a ductwork system will vary depending on whether or not a fire could have direct access to inside the duct through an unprotected opening. If in doubt, one should assume direct access, i.e. the prescribed Duct Type B scenario. The construction of PROMAPAINT® DC1 fire resistant ducts detailed in this document fulfil both Duct Type A and B requirements.

Required Fire Performance
To qualify as a fire resistant smoke extraction duct PROMAPAINT® DC1 fire resistant duct has also proven to be capable of maintaining a minimum 75% of its cross section area throughout the duration of the fire exposure. In specific occasions and situation, for example in ventilation-extraction ducts that run within a single compartment where the contact with combustible material and risk to personnel in contact with the duct is assessed as low, the fire authorities may exercise relaxation to waive the insulation criteria.

Supporting Structure
Care should be taken that any structural element from which the duct system is supported, e.g. a beam, floor or wall, must have as a minimum the same fire resistance as the duct system itself and must be able to support the load of the duct under fire conditions.

Hanger Support
The supporting steel hanger rods, channels and fixings should be appropriate for the load of the complete ductwork system including any applied insulation material or other services suspended from it.

Particular attention should be excercised where the hanging length of the hanger is too long where the effect of the thermal expansion may become a concern and where excessive expansion could place undue stress on the duct thus leading to premature failure during a fire incident. As a guide, hanger >2500mm should be given some attention in assessing this risk.

The stress allowance of the steel hanger rods for a 120 minute fire resistant duct should not exceed 10N/mm^2 and the centres of the hanger supports should not exceed 2500mm. These figures are based on research done on the stress and strains of steel members under simulated fire conditions.

The stress reduction ratio factors below are based on BS EN 1993-1-2: 2005. Similar figures can be applied from AS/NZS 4600: 2005/Amendment 1: 2010.

Fire resistance period	Approximate temperature	Maximum permitted stress	Maximum permitted centres
30 minutes	840°C	18N/mm^2	2500mm
60 minutes	950°C	10N/mm^2	2500mm
90 minutes	1000°C	10N/mm^2	2500mm
120 minutes	1050°C	10N/mm^2	2500mm
180 minutes	1110°C	6N/mm^2	2000mm
240 minutes	1150°C	6N/mm^2	1500mm

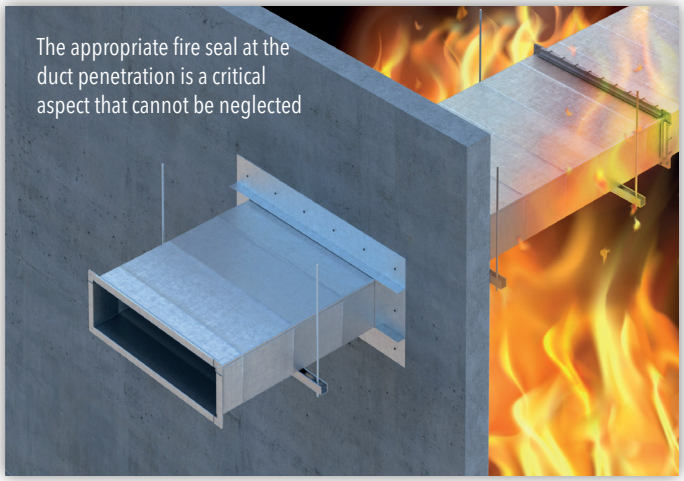
It should be noted that the stress levels referred to above apply to the threaded rod hanger supports themselves. The horizontal members have a differing level of applicable stress. The maximum centres refer to the greatest allowable distance between hanger support systems. However it should be noted that in certain locations, bends for instance, additional supports at lesser centres should be considered.

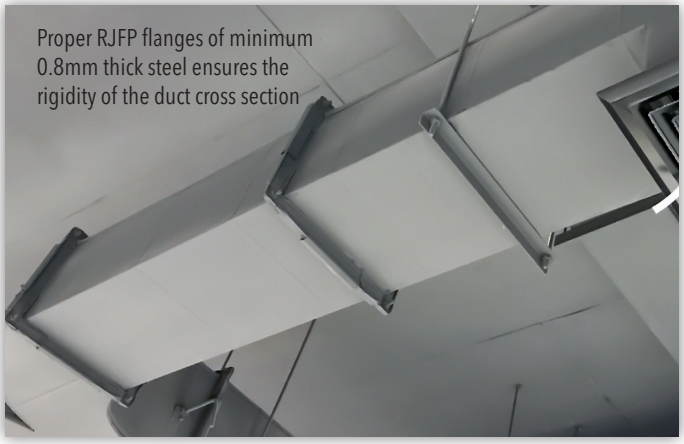
Where the hanger support system may exceed the limits given in the table above, the remedial options are as follows:

1) increase the dimensions of the hanger support system, e.g. rod diameters etc,
2) reduce the centres of the hanger support system, or
3) protect the hanger rods.

Steel Ductwork
The steel duct must be constructed in accordance with the requirements of DW/144, "Specification for sheet metal ductwork: Low, medium and high pressure/velocity air systems (published by the Heating and Ventilating Contractors' Association UK)" or equivalent specification, e.g. SMACNA. The steel ducts must be constructed with rolled steel angle-flanged cross joints. It is recommended that longitudinal seams be formed using the Pittsburgh lock system.

Penetrations Through Walls & Floors
Care should be taken to ensure that movement of the duct in ambient or in fire conditions does not adversely affect the performance of the wall, partition or floor, or any penetration seal. It should be understood that where a duct passes through any compartment wall or floor or other type of separating element, the aperture between the element and the duct must be sealed in accordance with the system approved for use with the specific duct system. In general this requires the use of a penetration seal constructed from materials and in such a manner to match the system used in the duct test programme. Penetrations seals are part of the tested duct system and the use of untested third party products or systems are not permitted.


The appropriate fire seal at the duct penetration is a critical aspect that cannot be neglected


Proper RJFP flanges of minimum 0.8mm thick steel ensures the rigidity of the duct cross section

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PROMAPAINT® DC1
ABLATIVE FIRE RESISTANT COATING FOR STEEL HVAC DUCTS

General description

PROMAPAINT® DC1 is a special acrylic based, single component coating, specially formulated to protect steel ducts up to E 120 minutes.

PROMAPAINT® DC1 forms a flexible layer once dry, it is very suitable for accommodating movement and also resistant to moisture.

PROMAPAINT® DC1 is a lightweight product which is designed to keep its adhesion to the steel surface even in case of stress and deformation due to extreme weather condition and in fire condition.

Steel duct protected with PROMAPAINT® DC1 has been tested according to BS 476 Part 24 for ducts A and B.

Fields of application

Compartmentation is widely used worldwide to limit fire spread throughout the building. Air ducts can be often a critical point, because they connect different compartments and, in case of collapse due to temperature, the sealing of the penetration though wall or ceilings can be compromised.

Fire dampers within ductwork systems are normally used to avoid flame and smoke spread, but in same cases, such as car park extract ducts, smoke extract ducts or pressurisation ducts, the fire dampers cannot be used, therefore a fire resistant duct is necessary. Depending on the building design and local regulations, the ducts can requires insulation and integrity or integrity only.

PROMAPAINT® DC1, applied to a thickness of approximately 0.5mm, improve the fire resistance of the steel ducts up to E 120 minutes, limiting the increase of weight and the external dimensions of the duct.

System advantages / customer benefit

- Up to 60% movement capability
- Excellent adhesion qualities
- Moisture resistant once dry
- Tested for accelerated aging both under Z1 (ETAG 018) and extreme conditions (up to 45°C, 90% humidity)
- Reduction in duct reinforcement
- Limit increase of weight and almost no increase in dimensions
- Easy to apply

Surface Preparation

It is important for long term durability that the galvanised steel ducts must be clean and free from any dust, oil, grease or any other contaminant prior to application of PROMAPAINT® DC1.

The steel duct surface should be cleaned with a solvent degreasing agent to ensure all surfaces are clean.

In case of critical adhesion, an appropriate etching primer (with a DFT of 60-80 microns) can be used within four hours after cleaning/degreasing.

Application of PROMAPAINT® DC1

- Stir PROMAPAINT® DC1 well (we recommend a mechanical mixer);
- PROMAPAINT® DC1 can be diluted (maximum 0.5 litre clean water to each 12kg container);
- PROMAPAINT® DC1 can be applied with a brush, roller or airless device;
- The recommendation of Promat is for the use of airless spray equipment, which will allow fast and simple application of the PROMAPAINT® DC1 in a single pass. The coating should be sprayed to a minimum dry film thickness (DFT) of about 500 to 600 microns.
- Once opened, the contents should be fully used as soon as possible. Reseal containers properly after use;
- Clean tools with water after use;
- 500 microns dry-film thickness is equivalent to 700 microns wet-film thickness (approx. 1.000 g/m^2);
- Top coat or overpainting is possible; adhesion and compatibility must be checked.

Application Conditions

- Minimum +5°C, maximum +40°C for both substrate and ambient temperature;
- Relative humidity of more than 65% will result in extended drying times;
- Substrate must be free of oil, grease and dust;
- Use clean water to dilute PROMAPAINT® DC1 if necessary.

Packaging

- 12 kg plastic bucket
- 33 buckets /pallet
- 396 kg/pallet

Subject to change.

Storage requirements

- Store in cool and dry conditions
- Protect from heat and frost
- Shelf life of original sealed containers at least 12 months
- Once opened, containers should be finished swiftly

Safety instructions

Please refer to the safety data sheet for additional advice

General Technical properties	
Colour	grey
Density	1.35g/cm^3
Viscosity	approx. 60.000mPa.s
Solid Content	approx. 70%
Ash Content	approx. 30%
Shore A	40
Tensile Strength	0.35 MPa
Elongation before failure	approx. 250%
Drying time	approx. 8 hours at 20°C and a relative humidity of 65% for 1mm

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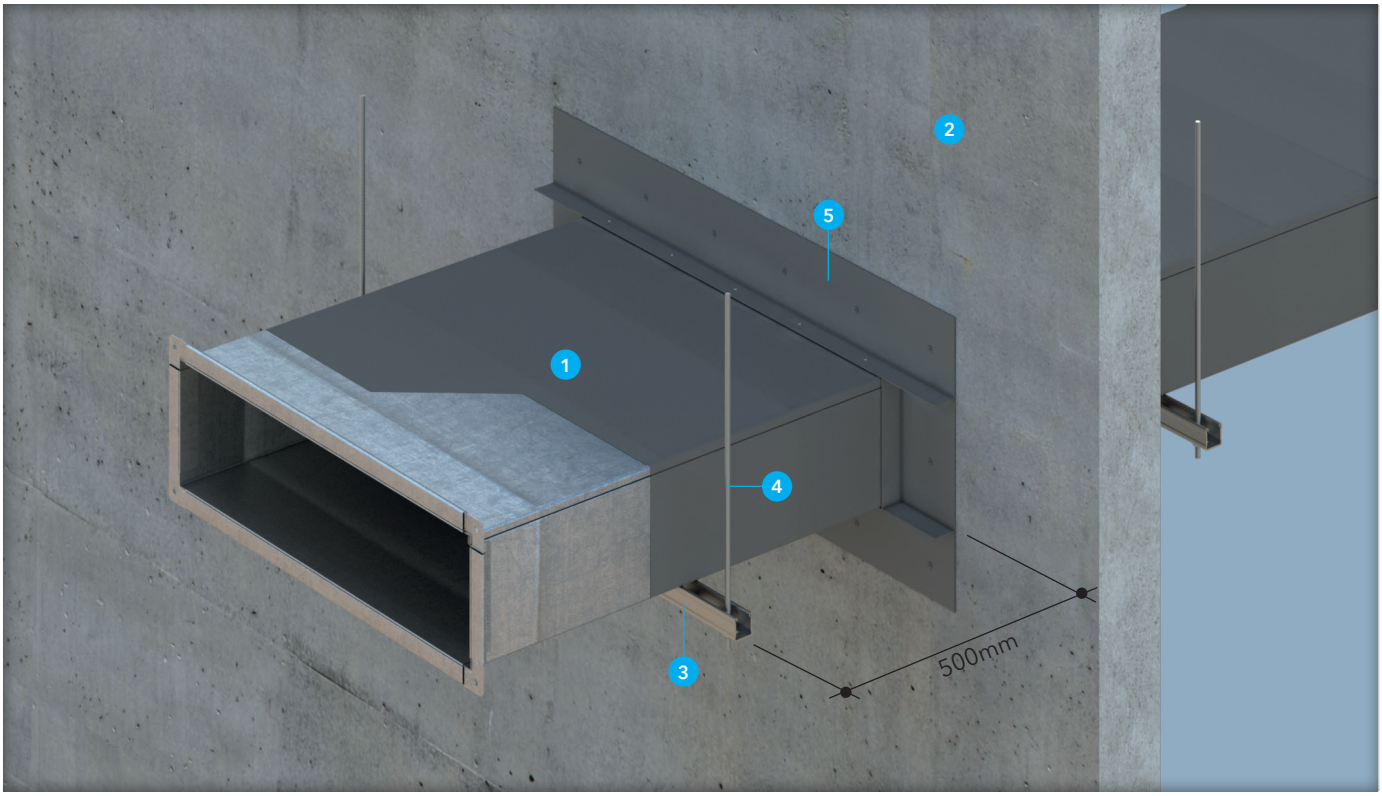
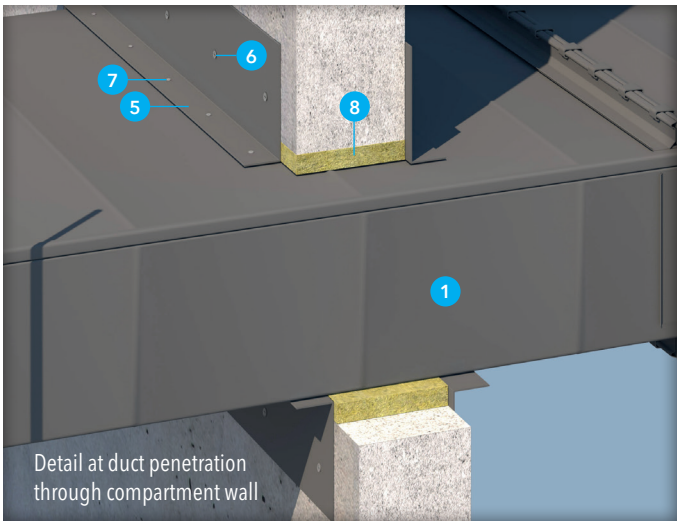
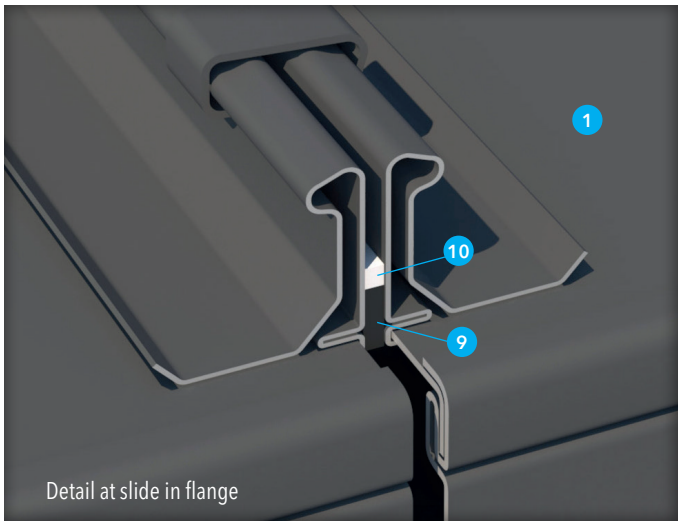




Detail at duct penetration through compartment wall



Detail at slide in flange

1. Galvanised steel duct coated with PROMAPAINT® DC1 (566 microns - DFT)
2. Concrete wall
3. Support angle or channel
4. M10 threaded steel rod
5. Steel angle 150 x 50 x 1.5mm thick
6. Universal screw 4 x 70mm length at 200mm on centres
7. Stainless steel rivets with 4.5mm head diameter, 50mm from side and maximum spacing of 120mm on centres
8. Mineral wool insulation 50mm x 100kg/m^3
9. EPDM gasket between flanges 4 x 12mm
10. PROMASEAL®-A between flanges

PROMAPAINT® DC1 fire resistant coating around steel ducts has be thoroughly tested in accordance with the criteria of BS 476: Part 24: 1987, exposed to external and internal fire. It meets the stability & integrity criteria for in excess of 120 minutes. PROMAPAINT® DC1 protected steel duct is also able to maintain 75% of its cross sectional area during the test duration and hence qualify as a fire resistant smoke extraction duct in accordance with BS 476: Part 24: 1987. Consult Promat Technical Department for further information.

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Etex is a Belgian industrial group that specialises and markets high quality building materials and systems. Founded since 1905 and headquartered in Brussels, Belgium, Etex currently operates in 107 factories and 102 subsidiaries across 42 countries, employs more than 15,000 people and is one of the largest fibre cement producers in the world.

Through its subsidiaries, the group offers an extensive range of products: small and large roofing materials, cladding and building boards, passive fire protection systems and ceramic tiles.

Etex aims to be a professional, solid partner for all kinds of building projects.

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