ASFP Technical Guidance Document 2

Code of practice for the use of sprayed mineral coatings for the fire protection of structural steel

Based on BS 8202 Part 1 for the mechanical retention of sprayed mineral coatings

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Association for Specialist Fire Protection (ASFP)

The Association was formed in 1976, and currently represents the majority of UK contractors and manufacturers of specialist fire protection products, with associate members representing regulatory, certification, testing and consulting bodies.

ASFP seeks to increase awareness and understanding of the nature of fire and the various forms, functions and benefits provided by passive fire protection.

It is willing to make available its specialist knowledge on all aspects of fire protection and can assist specifiers and main contractors in identifying products suitable for specific requirements, both in the UK and overseas.

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FOREWORD

This ASFP Technical Guidance Note has been prepared by members of the Association for Specialist Fire Protection.

SCOPE

The recommendations made in this Guidance Note are based upon BS8202: Part 1: 1993 for the sprayed application of lightweight mineral coatings which may, or may not, require mechanical retention for the fire protection of structural steel elements of construction.

REFERENCES

For further information regarding the application of sprayed fire protective mineral coatings refer to BS8202: Part 1: 1993.

INTRODUCTION

In recent years there have been varying specifications for the application of sprayed mineral coatings for the purpose of providing fire resistance to structural steel beams and columns.

This Guidance Note is for use of the specifier and specialist contractor to ensure all applications of a nominated material are based upon identical specifications for a specific contract.

It should be stressed, however, that site quality control is essential to ensure the recommendations made in this Guidance Note have been followed.

Test reports from a NAMAS approved laboratory must be available to confirm that the required fire resistance criteria can be achieved. Care must be taken to ensure that the fire test information is appropriate to the relevant specification.

PREPARATION OF STEELWORK

Primers are not usually required when Portland Cement - bound sprayed mineral coatings are applied to structural steel, provided the internal building environment is such that it will remain dry after the construction has been completed.

It should be noted that, when wet, Portland Cement has an initial pH value of between 12.0 to 12.5 and may therefore attack paints containing alkali sensitive binders such as alkyd resin. Paints with water sensitive binders may also be affected by spray coatings containing hydraulic binders.

Primers, if used, should not contain either aklali sensitive or water sensitive binders. It is essential to ensure the sprayed lightweight mineral coating is compatible with the material to which it is applied, and does not impair its performance or stickability.

METHODS OF MECHANICAL RETENTION

Galvanised steel components are most commonly used for the mechanical retention or reinforcement of sprayed fire protective coatings. Plastic coated or stainless steel components are also suitable, especially in areas of high humidity.

MESH

Keying Mesh (e.g. Expanded Metal or Ribbed Expanded Metal Lath)

This is typically of small aperture size (10mm-25mm) in order to allow the spray coatings to penetrate the mesh and produce a good key. It should be fitted close to the substrate, but can also be used to bridge gaps between elements of structure i.e.: between the flange of a beam or column and an adjoining floor or wall.

Reinforcing Mesh (e.g. Hexagonal Mesh (Chicken Wire) or Welded Steel Mesh)

This is typically of relatively large aperture size (50mm) in order to allow the spray coating to fully penetrate the mesh and act as reinforcement to the spray. Galvanised chicken wire is commonly used for this purpose when required, but the use of reinforcing mesh is not normally needed unless specified for the approved thickness to be used.

General

Mesh reinforcement will be required if there is no re-entrant detail.

Mesh reinforcement is likely to be required if the substrate is to be subjected to vibration. Reference should be made to the manufacturer is cases of likely excessive vibration.

Mesh reinforcement is required on "I" or "H" steel sections with dimensions exceeding 650mm between flanges and exceeding 325mm across flanges. Reinforcement is also required on circular sections with diameter greater than 325mm or on hollow sections with a single face exceeding 325mm.

MESH FIXING SYSTEMS

Continuous Fixings

Shot fired, stud welded or threaded fixings should be fitted to the steel substrate at

approximately 400mm centres and reinforcing mesh attached by means of non-return spring washers or clips. This method is particularly applicable to mineral slurry sprays.

Discontinuous Fixings

The type and spacing of discontinuous fixings will depend upon the size of the steel section and can be used where the dimension between flanges exceeds 650mm and the dimension across the flange exceeds 325mm.

Fixings consist of expanded metal squares retained by pins and non-return spring washers, bifurcated clips, large diameter spring washers retained on pins and bent pins. Discontinuous fixings should be spaced at approximately 250mm centres.

These methods of discontinuous fixings mainly apply to sprayed coatings based upon man-made mineral wool.

Box Encasement and Application to Hollow Sections

When box encasing "I" or "H" steel sections it may be necessary to use additional supports between the flanges to ensure the expanded metal lath does not span greater distances than that recommended by the lath manufacturer. The expanded metal mesh must be fitted taut and rigid for the application of the spray coating, in order to ensure a proper key. Loose fitting, and the resultant flexing of improperly fixed mesh, may lead to a detachment of the spray coating. The mesh should be spaced away from the faces of the flanges.

Reinforcing mesh can, if required, be wrapped around a hollow section and it may not be necessary to attach the mesh to the substrate. However, care should be taken to ensure that the mesh is not in direct contract with the steelwork, which would prevent penetration of the spray coating, and a consequent loss of key. If required, the mesh can be fixed with pins and clips and should be overlapped a minimum of 50mm at joints and wired together.

Application to Flat Surfaces

A positive means of fixing the mesh must be used on flat surfaces, such as the soffit of a concrete floor. Fixings can consist of shot-fired or threaded studs and the attachment of the mesh to the fixings can be made by means of non-return spring washers, or clips.

The type and spacing of discontinuous fixings to floor soffites will required 100mm x 100mm squares of mesh fitted to pins at a minimum spacing of 5 Nos per m². The mesh squares should be retained with non-return spring washers.

This method of discontinuous fixings apply to spray coatings based upon mineral wool when used as a combined fire protection/thermally insulating coating.

It should be noted that plastic pins, self-adhesive pins or adhesive fixed pins must not be used for the fire protection of elements of construction.

General Note - Mesh Fixing Systems

Mesh will not be required for applications where fire test evidence is available from a NAMAS approved laboratory which demonstrates that satisfactory performance can be achieved without its use.

RE-ENTRANT ANGLES

In many cases mechanical retention will be unnecessary, either because of the presence of a re-entrant angle, or because the element of construction is to be encapsulated by the spray coating.

In the absence of a re-entrant angle, or when the structural members are not encapsulated, mechanical retention should be used unless test evidence is available to demonstrate that it is not required. Methods and spacings of fixings are detailed in this document.

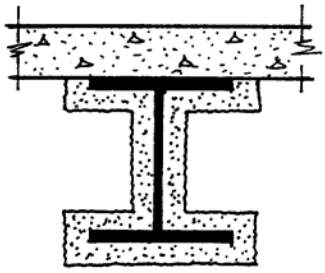
NOTES

BS8202: Part 1: 1993 states that mechanical retention should be provided unless:

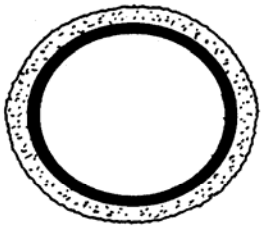
i) there is evidence from fire resistance tests to show that there is adequate bond between the spray and the substrate.

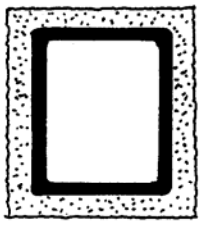
ii) the spray is locked into position by virtue of the shape of the element.

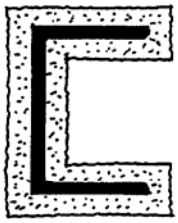
All materials should have been the subject of an appropriate fire test to ensure retention (stickability) of the mineral coating for the required period of fire protection.



RE-ENTRANT PROFILES

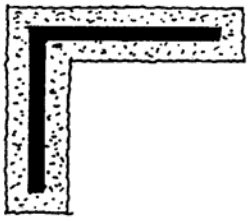


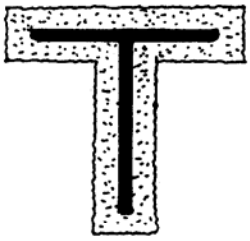




ENCAPSULATED PROFILES

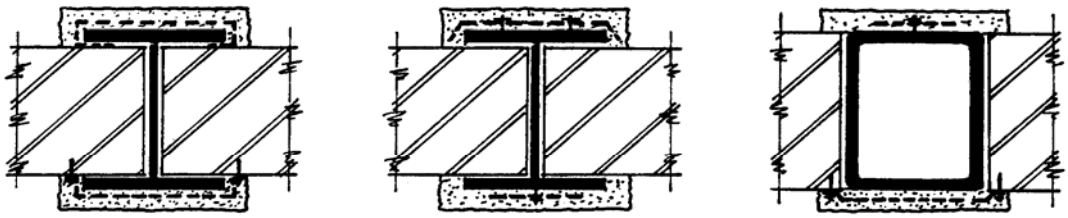
RE-ENTRANT PROFILE



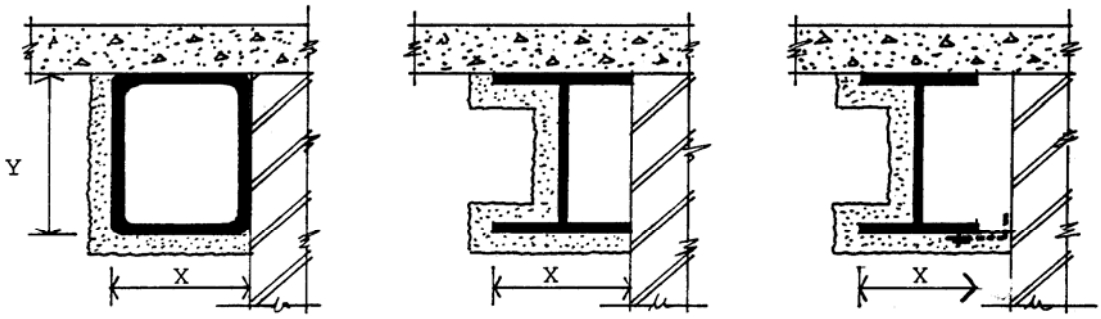


RE-ENTRANT PROFILES

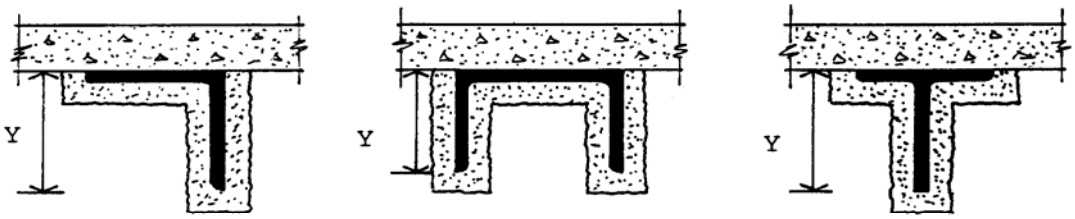
SECTIONS WITH RE-ENTRANT PROFILES AND ENCAPSULATION



Reinforcement required in all cases. The mesh may be fixed to the wall or steelwork but NOT, under any circumstances, fixed to both. If using expanded metal squares, fixed with speed fix washers as non continuous reinforcement, pins should be fitted at 250mm centres. Continuous mesh reinforcement may also be fixed to the flange of the steel section by means of pins and speed fix washers.

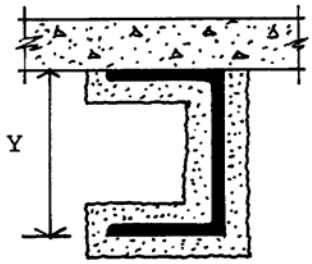


If distance X exceeds 160mm, mesh reinforcement should be fixed to the bottom flange. Mesh should only be fixed to the steel section when bridging gaps. If distance Y (in all cases) exceeds 325mm, mesh reinforcement should be fixed to the steel section. The wall/partition should provide at least the same degree of fire protection to the steel section as the sprayed mineral coating, ie: 1 Hr,2 Hr, Etc.

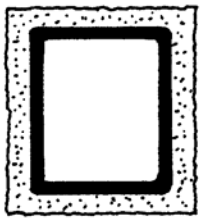


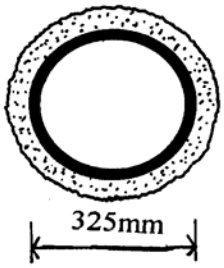
If distance Y exceeds 325mm mesh reinforcement should be fixed to the steel section.

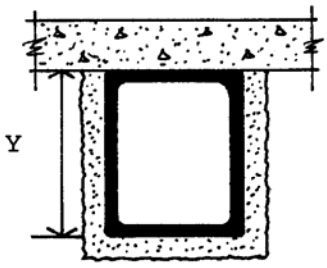
SECTIONS WITHOUT A RE-ENTRANT PROFILE OR ENCAPSULATION.



If distance Y exceeds 325mm mesh reinforcement should be fixed to the steel section.

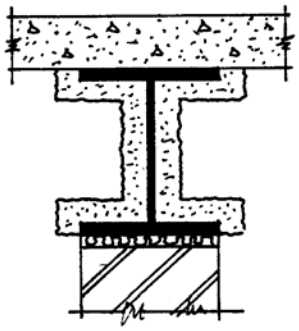






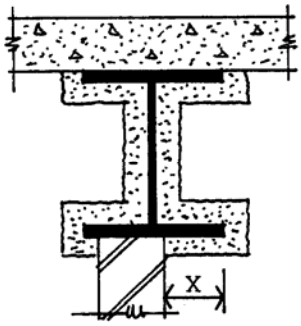
Rectangular hollow sections used as beams should be reinforced when any one face exceeds 325mm.(Y). When used as columns any face exceeding 325mm should be reinforced. Circular hollow sections do not require to be reinforced unless they exceed 325mm diameter.

SECTIONS WITHOUT RE-ENTRANT PROFILES



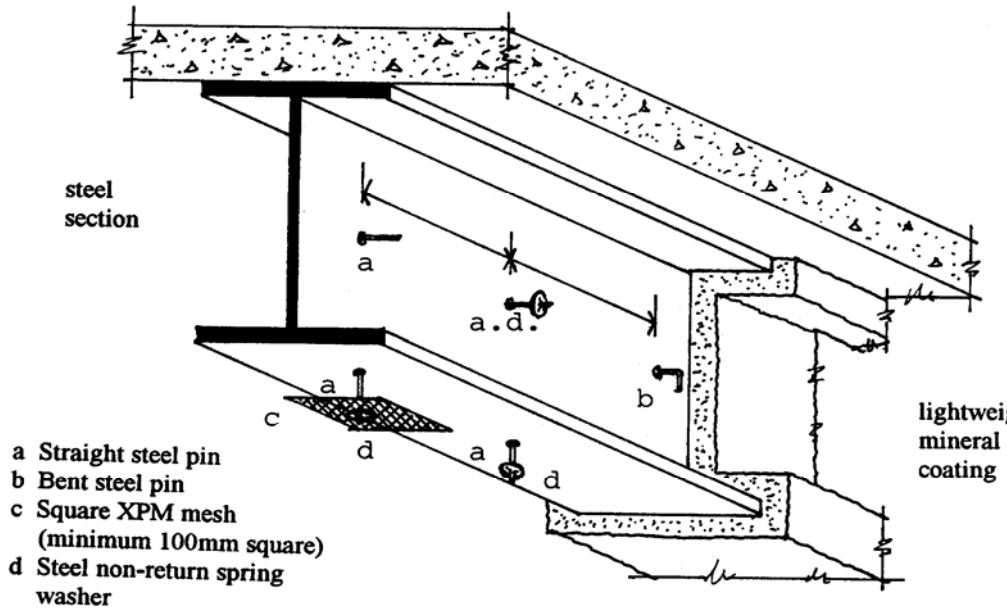
If a Compartment Wall incorporates an intumescent (or similar) expansion joint the spray coatings should NOT cover the joint. It is essential that the expansion joint material does not erode and expose the soffit of the flange.

TREATMENT OF EXPANSION JOINTS



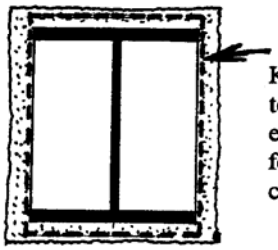
If distance X exceeds 160mm mesh reinforcement should be fixed to the overhanging bottom flange.

REINFORCEMENT TO FLANGE OVERHANGS

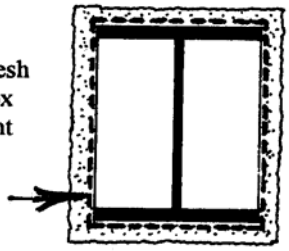


MESH AND/OR PIN REINFORCEMENT TO A STEEL BEAM

Retention mesh for mineral wool based coatings to be fitted in the outer third of the spray coating.



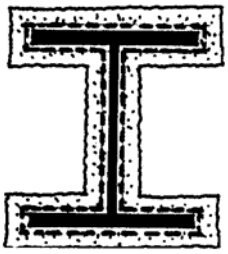
Keying mesh to form box encasement for spray coatings.



Keying mesh for slurry type mineral coatings fixed clear of substrate by a minimum of 6mm to allow for spray penetration.

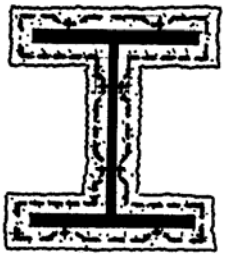
KEYING/RETENTION MESH FOR BOXED (HOLLOW) ENCASEMENT

Keying mesh for slurry type mineral coatings fixed clear of substrate by a minimum of 6mm to allow for spray penetration.



KEYING MESH
PROFILED PROTECTION

Note: Additional reinforcing mesh may also be necessary for particular thickness of spray. situations eg. large



REINFORCING MESH
PROFILED PROTECTION

Woven hexaganal reinforcing mesh fixed to welded pins. Use non-return spring washers or clips to retain mesh.