Promat

CAFCO MANDOLITE® CP2

Application Manual

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RECORD OF REVISION

Issue 1 / 12 December 2001 / First issue
Issue 2 / 7 January 2009 / Rebrand
Issue 3 / 31 July 2011 / CAFCO® SC125 changed to CAFCO® PSK 101; Cafco MANDOLITE® HS3 changed to Cafco FENDOLITE® MII and keycoat for galvanised substrate
Issue 4 / 27 February 2012 / Section 3.3, paragraph 3.
Issue 5 / 05 December 2013 / Amendment to Section 11.1; Theoretical Coverage
Issue 6 / 13 March 2022 / Rebrand

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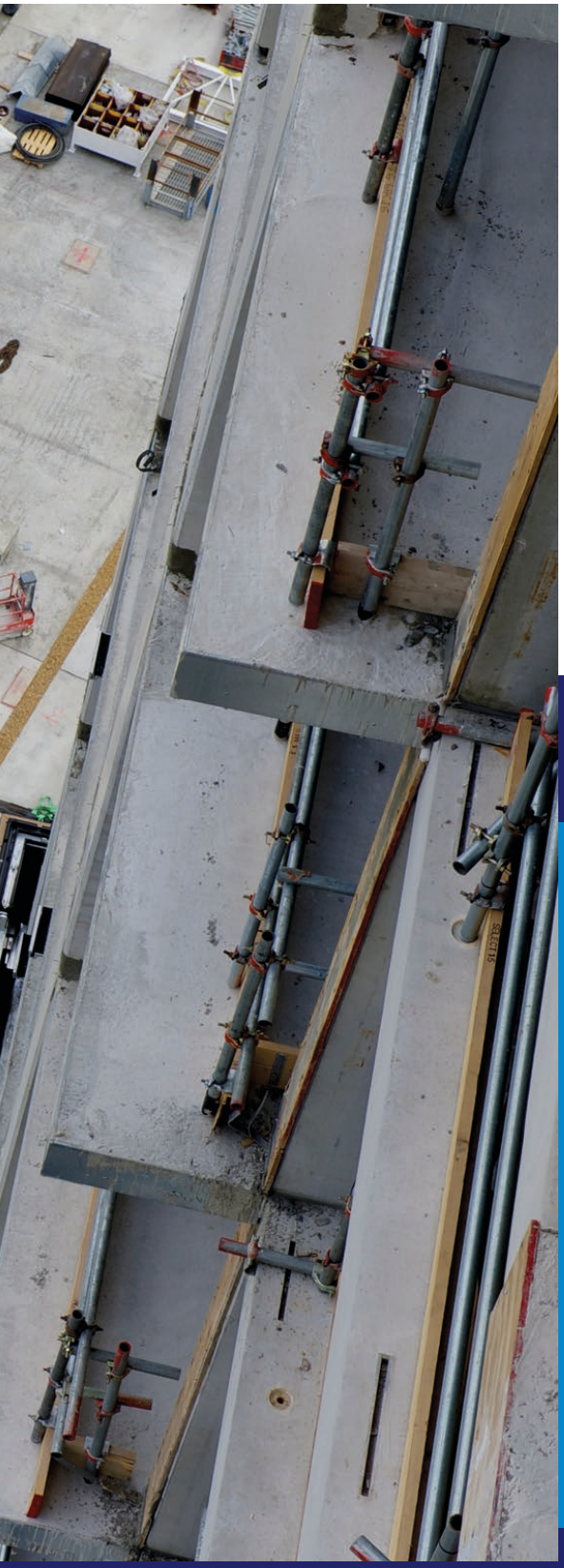
1. GENERAL



1.1 These instructions are intended as detailed guidance in the correct procedures for the application of Cafco MANDOLITE® CP2.

Where it is considered that these instructions do not address a specific situation that may be encountered reference should be made direct to Promat for advice.

1.2 Where relevant these instructions should be read

In conjunction with BS 8202: Part 1 : 1995 Coatings for Fire Protection of Building Elements : Part 1 : Code of Practice for the Selection and Installation of Sprayed Mineral Coatings.

2. PRODUCT DEFINITION

2.1 Cafco MANDOLITE® CP2
Is a single package, factory controlled premix based on vermiculite and Portland cement. Cafco MANDOLITE® CP2 is designed specifically for application by spray to structural elements in interior and limited exposure environments.

Structures protected with Promat's fire protective materials have been successfully tested internationally under cellulosic fire conditions for up to four hours duration.

2.2 Cafco MANDOLITE® CP2 Patch Mix
A specially formulated mix for hand application to small damaged areas of spray applied Cafco MANDOLITE® CP2.

2.3 Cafco FENDOLITE® MII
A vermiculite cement mix for use with CAFCO® SBR Bonding Latex in preparation of keycoat.

2.4 CAFCO® PSK 101
A multi-purpose product designed to act as a primer sealer (when used over alkali sensitive primers) and suitable key for the application of Cafco MANDOLITE® CP2.

2.5 CAFCO® SBR Bonding Latex
A bonding agent for use with Promat's keycoat.

2.6 CAFCO® PCG Mesh
A plastic coated galvanised 50mm x 50mm hexagonal mesh.

3. ON-SITE GENERAL GUIDANCE

3.1 Material Storage

3.1.1 Bagged Material
These materials must be kept dry until ready for use. They should be stored off the ground, undercover, and away from wet or damp surfaces or areas of very high humidity. Storage temperatures are not critical as long as dry conditions are maintained.

They can be stored for up to 12 months from date of shipment under good, dry conditions.

Each consignment should be completely used up before the following consignment is started.

3.1.2 Water Based Coatings
These products should be protected from frost and temperatures above 45°C. They should not be stored in high ambient temperatures or in direct radiant sunlight.

3.2 On-Site Application Requirements
The applicator should ensure that adequate services are available on the site, e.g. suitable electrical supply, compressed air, clean water of drinkable quality, surplus water and waste disposal facilities, heating and lighting if required.

3.2.1 Weather Protection
The materials must be protected from extremes of weather (freezing or warm drying winds, radiant heat or running water) during application and initial curing.

The materials should not be applied unless the substrate and air temperatures are at least 2°C and rising or if the substrate or air temperatures are less than 4°C and falling.

Maximum air and substrate temperature 45°C. Surface temperature should be at least 2°C above dewpoint temperature.

3.2.2 Drying
Provision should be made for adequate ventilation during and after application until the coatings are dry.

3.2.3 Masking
In some cases it may be necessary to mask off surrounding areas to protect from overspray.

3.3 Equipment
Equipment suitable for the application of Promat materials is widely available.

It is important, however, that any plant used should conform to the required technical specification indicated within this section.

Other types of equipment apart from those defined here may be satisfactory, but it is in the applicator's interest that such equipment is tested by practical trials and agreed suitable for use by Promat.

3.3.1 Equipment for the Application of Cafco MANDOLITE® CP2
- → A spraying machine based on a metal rotor/flexible stator, e.g. mono pump is recommended. Pump speed to be in the range of 100 – 600rpm.
- → A mechanical mixer, e.g. paddle blade or drum type concrete mixer should be used.

Minimum capacity 150/100 litre (5/3 ½ cu ft). Rotational speed 20 – 30rpm under load, maximum 35rpm free running.

Paddle blade mixers should be equipped with rubber (or synthetic equivalent) tipped blades to wipe the drum wall during mixing.

Small capacity mixers and mixers with too high a rotational speed should not be used as they are detrimental to Promat products.

- → An air compressor of adequate capacity is required. This may form an integral part of the spray machine or stand alone as a separate unit.

A capacity of 0.42m³ per minute (15cfm) free air delivery (FAD) and a pressure of 3.5kgf/cm² (50lbf/in²) is normally suitable at the spray head.

In cases where an air driven spray machine is utilised then reference should be made to the manufacturer to determine the necessary air capacity required to drive the equipment.

- A suitable sprayhead must be used in the application of Promat's sprayed cementitious materials.
- Hopper gun – where it is impractical to use the main plant for the purposes of applying the Keycoat, then a hopper gun should be used.

Generally hopper guns are based on a gravity feed principle using a 10mm (3/8 inch) face plate.

3.3.2 Equipment for the Application of CAFCO® PSK 101

- Airless Spray

Most industrial types are suitable. Use of 0.43mm – 0.54mm (17-21 thou) spray nozzle with appropriate filters.

Typical angle of fan 30° – 60° subject to substrate shape.

4. SITE PREPARATION

4.1 Background

It is the responsibility of the applicator to ensure that all backgrounds to be treated are in a suitable condition to accept the coating.

The substrate to be coated should be clean, dry and free from dust, loose millscale, loose rust, oil or any other condition preventing good adhesion. The substrate should also be chemically resistant to Portland cement.

4.2 Substrates

4.2.1 Bare Steel

Cafco MANDOLITE® CP2 has excellent adhesion to bare steel and since it is alkaline in nature, is likely to provide some measure of protection against further rusting. The alkalinity of the material will, however gradually decrease with time due to carbonation of the free lime in the Portland cement. Once the alkalinity has declined below a certain level, the fire protective material cannot assist in corrosion protection.

Promat therefore makes no claims as to the effectiveness of their materials as an anti-corrosive treatment to steel.

It is recommended that all steel is primed for exterior use. However, it is for the building designer to decide whether the risk of corrosion in the interior environment warrants the use of a priming system.

4.2.2 Primed Steel

Painted surfaces should be in a sound condition, fully cured and solvent released. The paint should have been applied in accordance with the paint manufacturer's instructions to the appropriate thickness.

Since Cafco MANDOLITE® CP2 contains Portland cement, it should not be applied to alkali sensitive primers e.g. those containing an alkyd binder. Any paint system used should therefore be stable when exposed to an alkaline pH of 12-12.5 e.g. two-pack epoxy resins are normally suitable.

4.2.3 Alkyd Primed Steel

In situations where an alkyd primer has already been applied to the structural steel it will be necessary to apply CAFCO® PSK 101 to act as a barrier coat between the alkyd primer and the Portland cement contained in Cafco MANDOLITE® CP2. For information on the application of CAFCO® PSK 101 in this situation please refer to section 5.

4.2.4 Galvanised Steel

Cafco MANDOLITE® CP2 has good adhesion to clean, hot dipped galvanised steel. A slight surface reaction can occur between Cafco MANDOLITE® CP2 and the galvanising but this does not appear to have any significant effects on the Cafco MANDOLITE® CP2 or the galvanised steel, unless the material is constantly in a wet environment. Under these conditions, a more extensive reaction may occur and pre-treatment with a suitable coating is advisable (e.g. CAFCO® PSK 101) as well as the use of an external grade fire protection material.

4.2.5 Composite Beam and Floor Assemblies

A series of fire resistance tests have been undertaken by the Steel Construction Institute, to examine the effects of leaving the void formed by a trapezoidal deck and its supporting beam unfilled in composite construction.

The results of these tests indicate that for fire resistance periods of up to 90 minutes the void may be left unfilled providing the design is fully composite although some increase in the thicknesses applied to the remaining three sides of the beams would be required.

In the case of non-composite construction or periods of fire resistance in excess of 90 minutes, the voids must be filled.

For specific advice and recommendations consult Promat Technical Services department.

4.2.6 Old, unknown or suspected multi-layer Paint Systems or substrates previously coated with Asbestos

Occasionally during building refurbishment work, or when a change of use of a building occurs, old primed steelwork not previously fire protected or steelwork which was previously covered with sprayed asbestos for fire resistance purposes may require treatment with Cafco MANDOLITE® CP2.

These backgrounds are not suitable for direct application of our products.

In these circumstances please follow the procedures outlined in Section 6.6 on page 21.

4.2.7 Expanded Metal or Ribbed Metal Lath

Expanded metal or ribbed metal lath may also be used to provide a suitable background over unacceptable backgrounds.

For method of use with Cafco MANDOLITE® CP2, over metal lath backgrounds see Section 6.7 on page 21.

4.2.8 Aluminium

Aluminium and aluminium alloy surfaces are alkali sensitive and require special treatment. It is recommended that a suitable etch primer be used. Promat Technical Services department can offer advice to suit particular circumstances.

4.2.9 Concrete

Most regular concrete substrates are suitable as a background for Cafco MANDOLITE® CP2. The concrete surface must be free from all release agents, contaminants and impurities. Special concretes with very high or very low suction properties or unusual thermal movement characteristics may require special treatment. Consult Promat in such cases.

4.2.10 Gypsum Plaster and Plasterboards

As Cafco MANDOLITE® CP2 materials contain Portland cement they should not be applied to gypsum plaster or plasterboard backgrounds.

4.2.11 Wood

Given the high shrinkage and moisture movement characteristics of timber it is not considered desirable to apply sprayed fire protective materials directly to this surface for the purpose of fire resistance.

Where situations arise which call for Cafco MANDOLITE® CP2 to come into contact with wood then the wood should be pre-treated with a suitable sealer e.g. CAFCO® PSK 101.

4.3 Other substrates

Where substrates or conditions other than those given above are encountered, advice should be sought from Promat Technical Services department.

5. APPLICATION OF CAFCO MANDOLITE® CP2

5.1 General

Cafco MANDOLITE® CP2 is a factory controlled pre-mix which only requires the addition of potable water on-site to produce a mix of pump-able consistency.

Cafco MANDOLITE® CP2 requires 20-24 litres/ 12.5kg bag. Prior to the application of any of the material the following points should be noted. Sufficient material should be conveniently placed by the pump and mixing equipment to ensure continuity of feed supply.

Pump and mixing equipment should be positioned to optimise the spray area available.

Prior to application, substrate and air temperature readings should be taken where relevant, as the products may suffer permanent damage when:

- They are frozen before they are cured sufficiently to resist disruption by freezing, or
- Their cure is affected by rapid migration of moisture due to excessive heat.

The following factors may assist application in cold weather:

- Warm mixing water may be used (up to 35°C).
- Shielding the work area from cooling winds.
- Using a heated enclosure. Care should be taken to prevent excessive evaporation of water.
- Any masking for the protection of sensitive areas should be carried out prior to commencement of application.

Note: Please see 'Weather Protection' on page 9.

5.2 Mixing – Cafco MANDOLITE® CP2

The following procedure is only applicable to conventional mixers and mono-pumps.

- Make sure that the mixer and all tools are clean.
- Ensure that mixing water is of a clean, drinkable quality.
- Place most of the required mixing water into the mixer.
- Partially set, frozen or lumpy material must be rejected.
- Add the bagged material steadily.
- Add remainder of the mixing water slowly until air entrainment occurs, normally after 90 seconds from commencement of the mix.
- Mixing time is 3 minutes to ensure correct properties of the mix.

As a general rule do not vary from the recommended quantities of water. Provided that mixing is almost continuous, the next batch can be prepared without washing out the mixer. The measured mixing water should be poured into the mixer so that it washes the remains of the previous mix from the walls of the mixer.

The workability of the mix will depend on ambient conditions.

However, as a guide and based on an ambient temperature of 20°C and a relative humidity of 50% the following should be considered typical:

- Cafco MANDOLITE® CP2 - up to 1 hour.

If the mixer is to be left for an extended period of time then it should be thoroughly cleaned with water and left ready for further use.

Additional water must not be added to regain workability.

Unworkable material must be rejected. Any partially set material left in the mixer must be cleaned out before further batches are mixed.

The following wet bulk density figures should be obtained at discharge from the mixer if mixing and water quantities are correct.

- Cafco MANDOLITE® CP2 - 480 – 640kg/m^3 (30-40 lbs/ft^3).

5.3 Spray Application of Cafco MANDOLITE® CP2

5.3.1 To Unprimed Steel

Cafco MANDOLITE® CP2 does not require a keycoat for application to clean bare steel.

- Check the condition of the substrate to ensure that it is clean, dry and free from dust, loose millscale, loose rust, oil or any other condition that would prevent good adhesion.
- Arrange the spraying machine and lines for convenient access so that the operator has freedom of movement over the area to be sprayed.
- Check that the spraying machine is clean and fully operational.
- Where a pump has not received a continuous supply of material, e.g. morning start up, clean water should be passed through the pump, hose and sprayhead.

When the mixed material is introduced into the pump sufficient material should be allowed to pass through the sprayhead to ensure that all traces of surplus pre-delivery water are removed and the correct mix consistency is reached.

The correct amount of air introduced at the nozzle is essential to ensure consistency of texture and correct density of material. An air pressure of 2.1 – 3.5 kgf/cm², (30-50 lbf/in²) and in the case of the CAFCO® Sprayhead 2.1 – 2.8 kgf/cm², (30-40 lbf/in²) at the sprayhead is suitable.

- Materials should be sprayed with minimum air pressure consistent with satisfactory application to give an even coating over the background building up in a series of passes. Even coats are obtained with steady sweeps of the sprayhead which is held, whenever possible, at 90° to the work surface. The sprayhead must not be held stationary.
- Wet bulk density at nozzle discharge should be:
- Cafco MANDOLITE® CP2 - 690 – 980 kg/m³ (55 - 65 lbs/ft³).

Note: Density figures determined under laboratory conditions.

- The materials have been designed so that they pump easily but stiffen and become cohesive as they are placed on the desired surface. This enables the specified thickness to be built up with the minimum number of coats (often only one).
- Do not apply a single coat of less than 8mm.
- Coating thicknesses should be continuously checked to ensure that the correct thickness is applied (see Section 12, page 27).
- Where structures include a horizontal surface that requires coating on the top side (e.g. top of the bottom flange of a beam) the first spray pass should be made on to that surface. This will avoid the possibility of reduced bond strength resulting from application onto loose over spray which can sometimes occur from prior applications to the adjacent surfaces.

Figure 1. Spraying sequence beams etc.

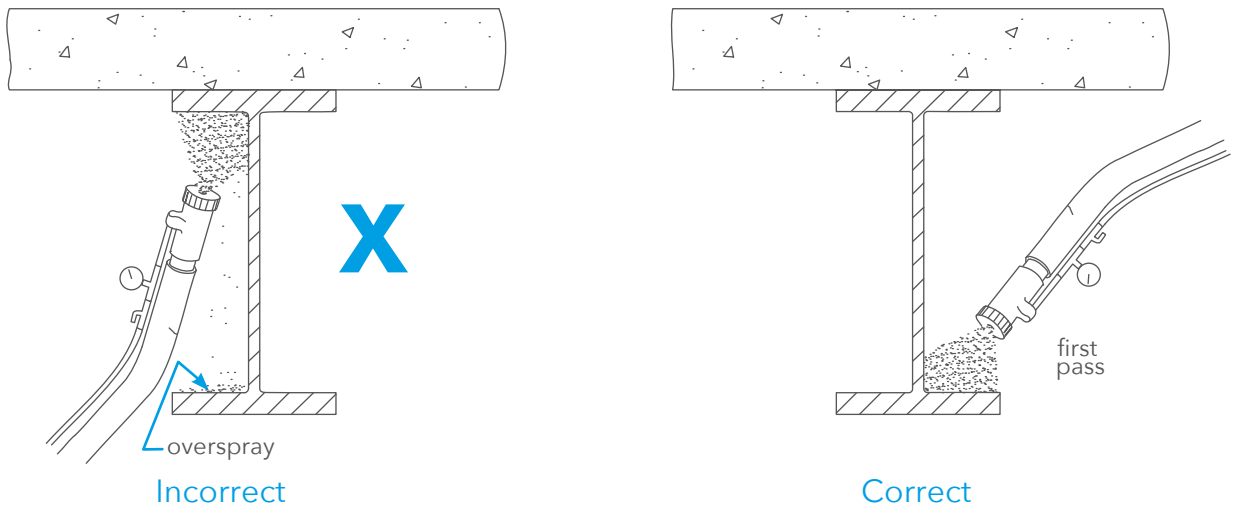
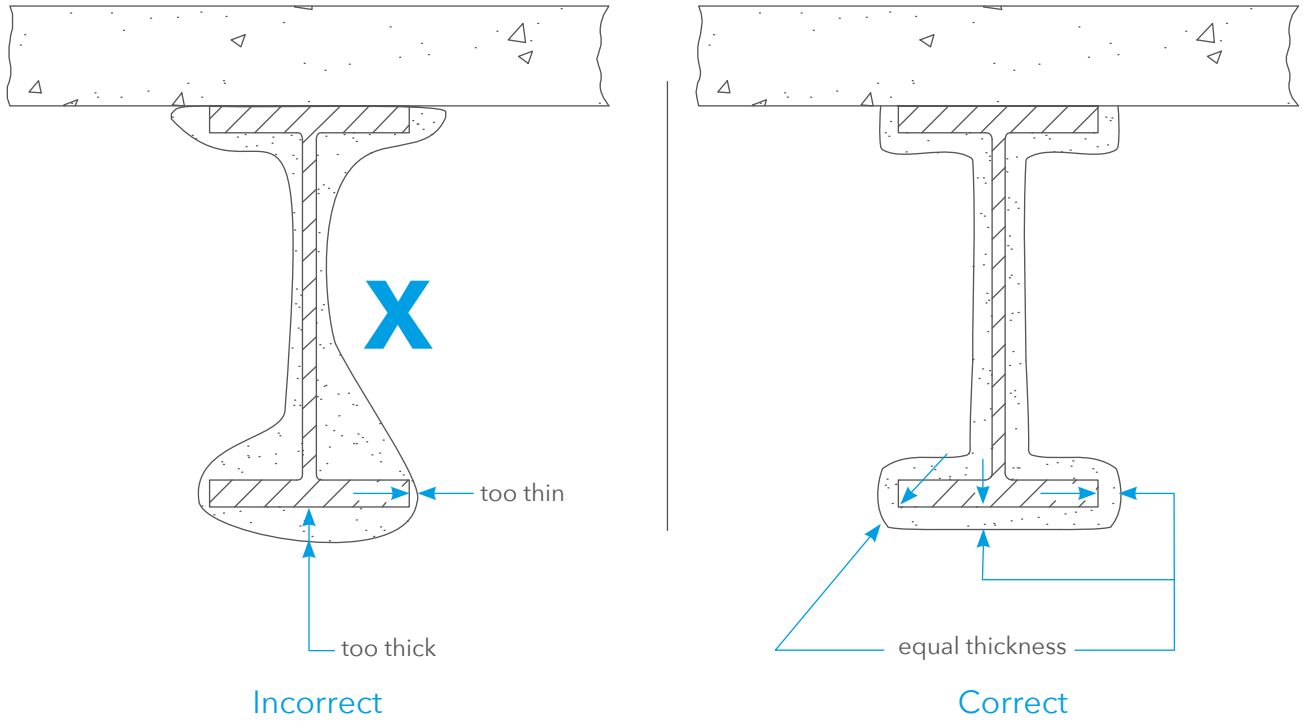


Figure 2. Uniformity of coating thickness.



- When applying the materials to beams and columns it is important that the coating thickness around the flange edges is the same as the thickness on the remainder of the section. Failure to observe this means that the full fire rating may not be obtained.
- For situations where the materials are applied in more than one coat, the preceding coat should be left with a spray texture finish or well scratched to ensure good bonding of subsequent coats.
- The time between coats will be subject to the environmental conditions at the time of application, however, for guidance:
- Cafco MANDOLITE® CP2 - 2 – 6 hours.

If the surface has become very dry, it should be well dampened with clean water before applying further coats, but must not exhibit a water sheen. Ideally subsequent coats, if required, should be applied within 48 hours of initial set of preceding coat.

5.4 Spray Application of Cafco MANDOLITE® CP2 to Compatible Primers and Galvanised Steel using Keycoat

Given the range and complexity of priming systems currently available, their compatibility with Cafco MANDOLITE® CP2 is an important consideration. The following section outlines the procedures for application of Cafco MANDOLITE® CP2 on compatible primers and galvanised substrates.

A Keycoat will be required on a compatible primer e.g. two-pack epoxies or a galvanised substrate.

Should there by any uncertainty with regard to primer compatibility or substrate condition, reference should be made to Promat Technical Services department. Given that primer compatibility / substrate condition has been determined as suitable the following procedures should be adopted prior to the application of the fire protective coating.

5.4.1 Keycoat

It is the responsibility of the applicator to ensure that the background to be treated is in a suitable condition to accept the keycoat. The applied primer should be in a fit condition to receive the fire protective system i.e. fully cured, bonded, solvent released and applied to specified thickness. A galvanised substrate may need to be degreased before keycoat application.

The function of the keycoat is to provide a tough, textured, strongly adhering mechanical key under ambient conditions for subsequent coats of Cafco MANDOLITE® CP2.

The keycoat is made up from a mixture of Cafco FENDOLITE® MII and CAFCO® SBR Bonding Latex.

Cafco MANDOLITE® CP2 SHOULD NOT BE USED FOR THIS PURPOSE.

5.4.2 Preparation

→ Make sure that the mixing equipment is clean. Add one volume of mixing water and one volume of CAFCO® SBR Bonding Latex to the mixer i.e. replace 50% of the mixing water normally used for the mixing of Cafco FENDOLITE® MII with CAFCO® SBR Bonding Latex.

This is best achieved before the mixing procedure is undertaken i.e. by removing 50% of the CAFCO® SBR Bonding Latex from its container and replacing it with water. This will ensure that the correct proportions of water/SBR are always introduced with the Cafco FENDOLITE® MII during the mixing procedure.

Typically one bag of Cafco FENDOLITE® MII will require 17 litres of this mixture to achieve the correct consistency.

On no account should the CAFCO® SBR Bonding Latex be added neat to the Cafco FENDOLITE® MII dry premix as lumps will be formed.

→ Add the Cafco FENDOLITE® MII slowly whilst mixing until a creamy pumpable consistency has been obtained.
→ Mixing time 3 minutes.
→ Unless a further mix is to be prepared immediately the mixing equipment should be thoroughly washed with clean water immediately after use.
→ Given the degree of coverage achieved from a one bag mix of keycoat (minimum 50m2) it may not be considered desirable to utilise the main mixing and spray plant. In such cases small quantities may be mixed in a bucket and applied by Hopper Gun (see Equipment, Section 3 on page 9) or CAFCO® PSK 101 may be applied following the procedure given in section 5.

ON NO ACCOUNT IS KEYCOAT TO BE APPLIED IN ANY OTHER MANNER THAN BY THE SPRAY PROCESS INDICATED BELOW.

5.4.3 Application

→ Spray the keycoat so as to give a 20-50% coverage of the background with blobs of material approximately 5mm in diameter. Best control will be obtained if the material is sprayed at a low throughput e.g. 7 litres/minute (¼ ft^3/min) using an 11mm internal diameter spray nozzle at low air pressure 0.7 kgf/cm^2, (10lbs f/in^2).

The keycoat must be evenly applied over the total area to be protected.

→ The keycoat must then be allowed to cure and dry thoroughly before proceeding with the application of the main fire protective coating. Since this is likely to take 10-36 hours, depending on drying conditions, it is advisable to complete as much of the Keycoat as possible in any one area before subsequent application of the fire protective coating.
→ Clean up all overspray or spills with water before the keycoat sets as the cured material is very difficult to remove.
→ Equipment used should be thoroughly cleaned immediately after application is complete.

5.5 Application of CAFCO® PSK 101 to incompatible primers

The application of cementitious coatings onto incompatible primers such as alkyds gives rise to the risk of chemical reaction between the two materials, leading to partial or total bond failure.

Such a reaction may take 12 weeks (or longer) to become identifiable and can be recognised by a characteristic cracking pattern, a hollowness of the fire protective coating when tapped or in the worst case material falling away from the substrate.

Identification of this reaction can sometimes be made by a characteristic "bleeding" of the primer into the fire protective coating.

CAFCO® PSK 101 has been specifically developed as an alternative keycoat system for application in situations where an alkyd primer has already been applied to the substrate.

When applied following the procedures indicated below CAFCO® PSK 101 acts as a sealer coat between the two systems.

5.5.1 Surface Preparation

Surfaces to be coated must be dry and free from oil, grease, and visible moisture (including condensation), dirt, loose paint, dust or other materials or conditions likely to impair adhesion of the CAFCO® PSK 101.

Old, unknown or suspected multi-layer paint system MUST NOT be over-coated WITHOUT reference to Substrate Section.

5.5.2 Application

CAFCO® PSK 101 must not be thinned and should be applied by one of the following methods:

- Airless Spray – most types are suitable. Use 0.43 – 0.54mm (17-21 thou) spray nozzle with appropriate filters. Typical angle of fan 30 – 60° subject to substrate shape.
- Rollers – use of lambswool roller is recommended.
- Brush – for best results use a wide soft nylon brush, of the type recommended for use with water based coatings.

The use of brush should only be considered for very small areas of application i.e. less than 1m^2.

5.5.3 Limitations of Application

Suitable surfaces which may be over-coated with CAFCO® PSK 101 include properly applied and cured alkyd primers.

Maximum time before over-coating with either a further coat of CAFCO® PSK 101 or Cafco MANDOLITE® CP2 is 2 months.

5.5.4 Number of Coats

Normally one, but additional coats can be applied as required.

Optimum thickness -
125 microns WFT - 69 microns DFT

Thickness Range -
100-150 microns WFT - 55-82 microns DFT

- DO NOT APPLY LESS THAN 100 MICRONS WFT.

5.5.5 Recoating

Ensure that the surface condition meets the requirements of "Surface Preparation" and "Limitations of Application" above.

5.5.6 Preparation

Touch dry - ½ - 1 hour at 20°C and 50% RH

Fully dry - 2 – 6 hours at 20°C and 50% RH

Drying times will vary with ambient conditions, but high humidity and low air change will hinder cure.

Once dry, application of Promat fire protective systems may take place following the procedures in Section 5 on page 13.

6. MESH REINFORCEMENT/RETENTION

6.1 General

For general use in the construction industry, Cafco MANDOLITE® CP2 does not require any form of mesh reinforcement / retention. However, mesh will generally be required if one or more of the following conditions are encountered:

- No re-entrant detail exists, i.e. there is no opportunity for the fire protection coating to "lock around" the substrate. If there is any doubt about use of mesh please telephone Promat Technical Services Department for advice.
- Where vibration, mechanical damage and a possibility of subsequent debonding exists.
- Where the web depth between the flanges exceeds 650mm and/or the flange width exceeds 325mm.
- Where the diameter of a hollow section exceeds 325mm.
- When any one face of a Rectangular Hollow Section (or RHS) used as a beam exceeds 325mm.
- Where a continuous application is required between two adjacent but separate substrates (but not bridging a movement joint).

6.2 Recommended Mesh Types

- Galvanised hexagonal mesh of size 50mm x 50mm x 1.0mm.
- Galvanised hexagonal mesh of size 50mm x 50mm x 1.4 – 1.6mm.
- CAFCO® PCG mesh 50mm x 50mm hexagonal mesh.
- Galvanised expanded metal lath BB264 (1.61kg/m²).
- Riblath 271 (2.22kg/m²).
- Riblath 267 (stainless – 1.51kg/m²).

Other galvanised expanded metal lath may be suitable but must be confirmed as such by Promat in writing prior to their use on site.

6.3 Methods of Use

The foregoing recommended mesh types fall into two categories:

- Reinforcing mesh.
- Retention lath.

Hexagonal reinforcing mesh may be required on a steel beam or column and will generally be fixed to and around the profile of the substrate so as to be within the mid third of the applied coating thickness.

Partial meshing of deep web/wide flange sections, e.g. plate girders, is acceptable providing the following conditions are observed:

- The unmeshed portion of the web must not exceed 650mm above or below the centralised meshed area.
- The unmeshed portion of the flange should not exceed 325mm before re-entrant detail occurs.
- The minimum width of mesh reinforcement permitted on either web or flange is 300mm.

Retention lath can provide a suitable background on unsuitable substrates e.g. old, poor quality concrete. Retention lath may also be used to bridge a gap between, for example, a pair of parallel beams (not over a building movement joint) or to bridge a gap between a steel beam or column and an adjacent wall where there is no possibility of protecting the back face of the beam.

- Cafco MANDOLITE® CP2 is suitable for application to the profile of a section.
  It may also be used over expanded metal lath providing the following limitations are observed.
- It may be applied to EML used to bridge gaps between parallel sections or a section adjacent to a wall where the back face of the beam cannot be protected.

Note: The EML may be fixed to the steel section but must not be fixed to the wall.

- It may be applied to Riblath securely fixed to a soffit coated with an unsuitable finish.

6.4 Fixing Methods

6.4.1 Reinforcing Mesh around the profile of a section

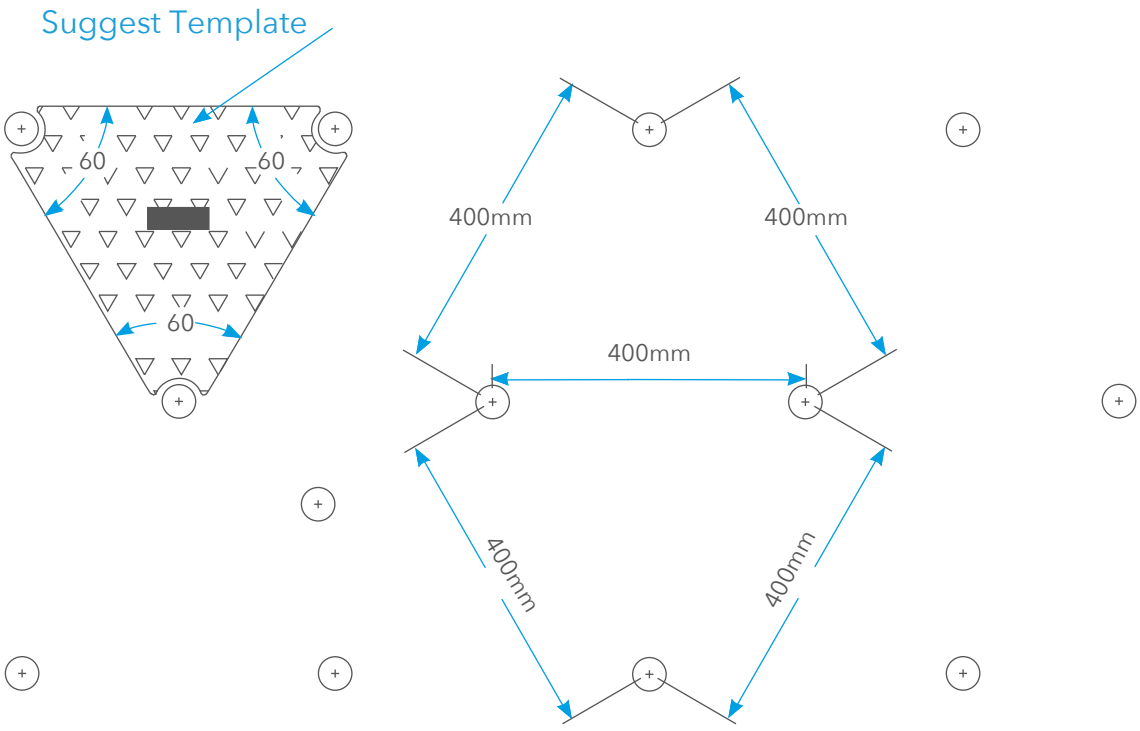
The reinforcing mesh should be fixed to the steel substrate using capacitor discharge (stud welded) pins or (where permitted) percussion type fixings at approximately 400mm centres on a staggered pitch.

- Mild steel pins of not less than 3mm diameter (length to suit applied thickness) with galvanised non-return (Speed Fix) washers should be used to secure galvanised hexagonal reinforcing mesh.
- The welded pins should be capable of being bent once through an angle of 45° and back to their original position without failure at the welded joint or in the case of a helical pin, rotated through 90° and back to its original position without failure at the welded joint. (See section 12).
- Self-adhesive, glued or plastic pins must not be used without prior consultation and confirmation in writing by Promat, as their performance under fire conditions is generally inadequate for normal failure criteria.

Such fixings may be approved by Promat when they act as a temporary fixing to assist location of reinforcing mesh where the fire protective material cannot fall away under fire conditions. Such applications must be approved in writing by Promat before commencement of work.

- When mesh is applied it must be overlapped by at least 50mm at the joins. No more than 3 layers should overlap at any one point.
- For thickness of fire spray up to 45mm, the mesh may be applied prior to application. It is important that the mesh is not hard up against the substrate, therefore once secured by clips, the mesh should be pulled away from the substrate so as to lie substantially in the middle third of the thickness being applied.
- Where the thickness exceeds 45mm, the mesh may be fixed to a suitable length pin after application of approximately half the fire spray thickness.
- When reinforcing mesh is used, the minimum practical thickness of Cafco MANDOLITE® CP2 that may be applied increases from 8mm to 15mm.

Figure 3. Reinforcing mesh around the profile of a section.



6.5 Application over old, unknown, or suspected multi-layer paint systems

6.5.1 Method 1

Shot blast all steel surfaces to remove all contamination, rust, paint, etc., and proceed as for application to bare steel, section 5.

6.5.2 Method 2

Remove loose rust or flaky paint by manual or power wire brushing. Locally grind back to bright metal and fix stud welded pins to the substrate at 400mm centres (maximum).

Alternatively percussion fixings may be used. Apply one coat of CAFCO® PSK 101 (section 5). Fix hexagonal reinforcing mesh to pins and ensure that it will be in the mid third of the applied thickness. Apply Cafco MANDOLITE® CP2.

Note: Although the application described in Method 2 above will provide the required fire resistance, our experience with this type of application suggests that cracking and de-bonding may occur, but since the materials will be reinforced, their stability in fire can be assured.

6.6 Substrates previously coated with Asbestos

In situations where asbestos has been removed from a steel (or other substrate) it is normal practice to encapsulate any residual fibres remaining on the substrate (which have not been removed in the stripping process) with a PVA or other approved encapsulant.

Since shot blast cleaning of this type of substrate is not likely to be permitted for safety reasons we recommend that expanded metal lath or Riblath is fitted to form a box encasement of the beam or column and that Cafco FENDOLITE® MII is applied.

Note: When asbestos has been removed from a soffit, see guidance given in section 4.

6.7 Expanded metal lath for applications to soffits with unsuitable finishes

When it is necessary to apply Cafco MANDOLITE® CP2 to a new concrete (or metal deck) soffit to increase its fire resistance this can be generally achieved by direct spray application.

If during a refurbishment project, for example, an old or previously painted or plastered soffit or a soffit from which asbestos has been removed is required to be upgraded, direct application of Cafco MANDOLITE® CP2 is not recommended due to the possibility of chemical incompatibility between the existing treatment (or residual asbestos encapsulant) and a Portland cement based coating.

In such situations it is recommended that Cafco MANDOLITE® CP2 is applied to galvanised Riblath 271 (or equal) that has been fixed to the soffit in accordance with manufacturers recommendations using suitable metal fixings at maximum 600mm centres.

6.8 Expanded metal lath for bridging between two substrates

Where a “bridge” situation exists between two sections, e.g. steel beam to steel beam or steel beam (or column) to wall and spray application of the back face of the section is not physically possible, Cafco MANDOLITE® CP2 may be applied to a metal lath which spans the gap. The type of lath and fixing method will vary and may involve consideration of differential movement. Where such situations are found to exist, reference should be made to Promat Technical Services department.

Note: The minimum practical thickness that may be applied to a metal lath substrate is 13mm proud of lath.

7. SURFACE FINISH

7.1 Cafco MANDOLITE® CP2

Cafco MANDOLITE® CP2 is designed for spray application to achieve a textured finish. In certain special circumstances it may, however, be levelled after application.

For example, where it is deemed necessary to rectify any minor imperfections in profile.

If it is necessary to reduce the thickness significantly it is better to cut the material with a tensioned wire or metal trowel.

Once levelled, if necessary an immediate application of a thin spray coat of Cafco MANDOLITE® CP2 will help to disguise any trowel marks.

8. THICKNESS CONTROL

8.1 When each surface to be protected is required to have the same thickness

As in the case of steel I section columns and beams, at least one thickness measurement every 3 metres should be taken on each surface of the flanges and the web. On steel I sections, the spray coating on the flange should not be permitted to taper off toward the flange edge.

Where there appears to be such tapering, the thickness should be checked across the flange and over the flange edges at the recommended nominal 3 metre intervals. It is considered advisable to record measured thicknesses.

Conditions of Acceptance for reduced thickness: (in accordance with BS 8202 : Part 1 : 1995 Code of Practice for the Selection and Installation of Sprayed Mineral Coatings Section 9.9.4.) Where the thickness is found to be less than the specified thickness, the area may be reconsidered for acceptance, subject to the following conditions:

- The deficient area is not greater than 1m², the thickness is not less than 85% of the specified thickness; no other deficient area occurs within 3m of the area in question.
- The deficient area is not greater than 0.2m², the thickness is not less than 75% of the specified thickness; no other deficient area occurs within 1m of the area in question.

9. CAFCO MANDOLITE® CP2 REPAIR PROCEDURES

9.1 Damage during the application period

When site alterations etc. cause local damage during the application period, Cafco MANDOLITE® CP2 is normally repaired by a further spray application. If, however, subsequent damage occurs either accidentally or deliberately it is usually more convenient to affect a repair by the use of a hand applied Patch Mix.

Cafco MANDOLITE® CP2 should not be hand applied direct from the mixer. A Cafco MANDOLITE® CP2 Patch Mix has been developed for this purpose.

Note: Hand patching to Cafco MANDOLITE® CP2 is limited to areas not exceeding 1.5m².

9.2 Instructions for Application

Cut away any loose Cafco MANDOLITE® CP2 chamfering any sharp edges.

Where hexagonal mesh is exposed, clear the material away from the mesh and ensure that it remains substantially in the mid third of the final coating thickness.

Remove loose dust.

Mix the Cafco MANDOLITE® CP2 Patch Mix
Mix with clean drinkable water to a consistency suitable for application with a trowel.

Cafco MANDOLITE® CP2 Patch Mix
A 12.5kg bag of patch mix will require approximately 20 litres of mixing water.

For areas of potential difficulty, and where a full thickness of coating has to be reinstated, for example the underside of a beam, and no reinforcing mesh is present, it is advisable to fix galvanised hexagonal mesh to the substrate.

If mesh was used in the original application but has been subsequently removed together with Cafco MANDOLITE® CP2 an additional section of mesh must be attached to the remaining mesh. The mesh should be pulled away from the substrate to lie substantially within the mid third of the final applied thickness.

Where the material to be patched has become very dry it is likely to require dampening with clean water.

If more than 12mm thickness is required it may be necessary to apply the material in more than one coat.

Apply the Cafco MANDOLITE® CP2 Patch Mix with a trowel allowing some overlap onto the existing material.

If more than one coat is required, allow the preceding coat to take its initial set.

Preceding coats should be left with a rough finish or scratched to ensure good bonding of subsequent coats.

For small areas, e.g. less than 0.5m² it is likely that Cafco MANDOLITE® CP2 Patch Mix can be applied in one thickness to the total required thickness.

If the area of damage is larger than 0.5m² then more than one coat may be applied as required.

10. ADDITIONAL SURFACE FINISHES

10.1 Additional surface finishes

May be applied to Cafco MANDOLITE® CP2 but they must be of a type approved by Promat. Application of the wrong type can adversely affect the properties of the fire protective coatings.

10.2 Before applying any surface finish

The fire protective material should be allowed to cure and dry for as long as possible and at least until its colour changes from the grey colour of the wet material to a light grey of the drier material.

The moisture content of Cafco MANDOLITE® CP2 must be at or below 8% before application.

10.3 Finishes

10.3.1 Emulsion Paints

Emulsion paints may be used for purely decorative purposes. The paints should be of good quality and suitable for direct application to concrete substrates. The coating thickness should be kept to a minimum. Application is normally by airless or conventional spray.

10.3.2 Other Coatings

For other coatings than those outlined above, please refer to Promat Technical Services department.

11. THEORETICAL COVERAGE

11.1 Cafco MANDOLITE® CP2

The following theoretical coverage figures are given for guidance only. Practical coverage will be influenced by such factors as mixing, pumping and spraying techniques which can affect applied density and wastage, the degree of site control, size and shape of items being protected, frequency of stoppages.

- Cafco MANDOLITE® CP2 based on a density of 390kg/m³ – 258m²/tonne at 10mm thick or 3.65m²/12.5kg bag at 10mm thickness
- Cafco FENDOLITE® MII Keycoat minimum 50m²/bag
- Cafco MANDOLITE® CP2 Patch Mix – see Cafco MANDOLITE® CP2 above.

11.2 Water Based Coatings

The coverage figures quoted are calculated by a method adopted for paints. Practical coverage will depend on several factors, e.g. surface texture, application techniques, substrate porosity and can best be determined by practical trial.

- CAFCO® PSK 101 – 8.0m²/litre at 125 microns WFT

PROMAT WILL NOT BE HELD RESPONSIBLE FOR ACTUAL COVERAGE RATES ACHIEVED ON SITE OR THE EXTENT OF WASTAGE AS THESE MATTERS ARE OUTSIDE ITS CONTROL.

12. QA/QC PROCEDURES

12.1 General Guidance

These procedures are for the guidance of both the client and the applicator. They may be amended for specific contracts by agreement with Promat Technical Services department.

Cafco MANDOLITE® CP2 is produced in modern, highly automated plants, subject to stringent quality control procedures.

The effective utilisation of these products requires equal attention to site quality control.

The applicator is responsible for ensuring that all raw materials as delivered to site are of the correct type and in good condition.

If there is any variation, consult with the client and/or Promat for clarification. The applicator should produce a raw materials quality control sheet, indicating inspection of each delivery to determine acceptance. This sheet is to be made available to the Client and Promat on request.

Once raw materials are accepted into store at site, the applicator is responsible for ensuring that they are stored in suitable conditions and are used within their prescribed storage life (where applicable).

The applicator should have on site at least one person who has attended an introductory course in the application techniques of Cafco MANDOLITE® CP2.

The applicator should appoint one person from his team on site to organise the QA/QC procedure as required.

A typical sample should be prepared as part of the contract to act as a reference in matters of mesh location and fixing (where required), firespray thickness and surface texture.

This sample could either be a special item or more usually, a site beam or column.

This typical sample area should be approved by the client's representative in writing and clearly identified so that it may be used as an aid to settle any subsequent disputes that may arise.

12.2 Quality Control/Inspection

12.2.1 Substrate Inspection

Check that the substrate is in a suitable condition before proceeding. It should be dry and free from oil, grease, loose rust, dirt, dust, scale or any other material likely to impair adhesion.

12.2.2 Pin Fixing (where required)

The welded pin areas shall be inspected for:

- Correct grinding of surface to bright metal.
- Correct type, spacing and fixing of pins, including a 45 degree bend test for straight pins or a 90 degree rotation test for helical pins, at not less than one test per square meter. Maximum allowable failure rate of not more than 10%.

12.2.3 Keycoat (for application to compatible primers)

Check the keycoat has been applied correctly and is adhering well to the substrate.

12.2.4 CAFCO® PSK 101 (for application to incompatible primers)

Check the CAFCO® PSK 101 has been applied in accordance with Promat recommendations.

12.2.5 Mesh Fittings (where required)

The mesh should be galvanised hexagonal or CAFCO® PCG mesh.

Check the fitting of the reinforcement mesh, ensure that clips are fitted correctly and that overlaps between sections of mesh are to specification.

Prior to commencement of spraying, the mesh should be checked to ensure it is pulled away from the substrate to lie substantially in the middle third of the final coating thickness.

The effectiveness of the entire reinforcement system is negated if mesh is left hard against the substrate.

12.2.6 Weather Conditions

Prior to application, substrate and air temperatures should be taken. Freshly applied wet cementitious products such as Cafco MANDOLITE® CP2 may suffer permanent damage if they are frozen prior to their initial set taking place. The temperature during application should therefore be recorded.

The product should not therefore be applied unless the substrate and air temperature is at least 2°C and rising or if the substrate or air temperature is less than 4°C and falling.

The following factors may assist application in cold weather:

- Warm mixing water may be used (up to 35°C).
- Shielding the work area from cooling winds.
- Using a heated enclosure. Care should be taken to prevent excessive evaporation of water.

The maximum air and substrate temperature at which Cafco MANDOLITE® CP2 should be applied is 45°C. The surface to be protected should also be at least 2°C above the dewpoint temperature.

12.3 Density Measurement and Slump Tests

12.3.1 Density Measurement

During normal spraying operation, take a daily sample of material from both the mixer and sprayhead (sprayed into a bucket or onto a hawk) working in the normal mode. The samples should be taken in a standard container of known volume (without the use of agitation to increase packing rate).

Using the edge of a trowel or a tensioned wire, level the top of the samples by cutting back immediately after spraying or sampling from the mixer.

DO NOT COMPRESS THE SAMPLE.

Weigh the samples within ten minutes and record the bag numbers, the time the samples were taken and from the weight and volume, calculate the wet densities and record these values.

12.3.2 Slump Test (only required on material from mixer)

Apparatus

- A flat clean plate.
- Straight edge for levelling (e.g. palette knife.)
- 150mm rule.
- Plastic slump tube (104mm ID x 120mm long = 1 litre volume).
- Spring balance reading – 2kg in grams.
- Plastic bags sufficient to contain 2 litres and strong enough to hang on spring balance.

Procedure

- Identify and record bag numbers and note number of bag(s) used for mix.
- Record mix water quantity used and mix time.
- After mix has been discharged into hopper, fill the plastic tube (pre placed on flat plate) with mix and cut back to level off at top. (Do not agitate or compress the sample into the tube.)
- Raise tube slowly and carefully vertically until the sample has slumped back out onto the plate.
- Place the tube upright on the plate adjacent to the slumped material.
- Using the straight edge and 150mm rule measure and record the vertical distance from the top of the tube to the top of the concave depression at the top of slumped material.
- Place slumped material into plastic bag.
- Weigh bag plus sample and record result.

Note: The plastic tube has a volume of one litre, therefore weight of the sample in grams taken from above procedure will represent density in grams per litre which is numerically the same as density in kg/m^3.

12.3.3 Results

The values obtained by following the foregoing procedure should lie within the following ranges:

Density from mixer discharge - 480 – 640kg/m^3

Density at sprayhead - 690 – 980kg/m^3

Slump - 55 – 75mm

12.4 Surface finish

Cafco MANDOLITE® CP2 is a fire protective coating for steel and other substrates. Its role is to provide enhanced fire resistance in a cellulosic fire to commercial structures.

The specified thicknesses are a minimum requirement, however minor thickness variations may occur.

The surface finish should be even with a fine textured spray. The aesthetic appearance of the surface is a matter of personal preference. However, if points above are recognised and control of thickness is maintained as described below, the result should be satisfactory.

If a particular aesthetic standard is required, however, this should be clearly specified and allowed for in the typical sample area.

12.5 Thickness Control

When each surface to be protected is required to have the same thickness, as in the case of steel I section columns and beams, at least one thickness measurement every 3 metres should be taken on each surface of the flanges and the web.

On steel I sections, the spray coating on the flange should not be permitted to taper off toward the flange edge. Where there appears to be such tapering, the thickness should be checked across the flange and over the flange edges at the recommended nominal 3 metre intervals.

Conditions of Acceptance for reduced thickness : (in accordance with BS 8202 : Part 1 : 1995 Code of Practice for the selection and acceptance of Sprayed Mineral Coatings Section 9.9.4).

Where the thickness is found to be less than the specified thickness, the area may be reconsidered for acceptance, subject to the following conditions:

- The deficient area is not greater than 1m^2, the thickness is not less than 85% of the specified thickness, no other deficient area occurs within 3m of the area in question.
- The deficient area is not greater than 0.2m^2, the thickness is not less than 75% of the specified thickness, no other deficient area occurs within 1m of the area in question.

12.6 Surface Treatments

12.6.1 Topcoat Painting (where required)
Check the topcoat paint has been applied in accordance with the specification and/or the manufacturer's recommendations.

12.7 Completed Areas
Completed areas should be checked by the client with the applicator in attendance and passed in writing as acceptable before the applicator vacates the area.

12.8 Repair Work
If the applicator is requested by the client to return to a completed area for repair work, the repair should conform to the relevant requirements in this Application Manual.

The applicator should not return to a completed area to carry out repair work unless they have written confirmation that such repair work is released to them.

12.9 Independent Quality Checking
The client may appoint an independent testing house to carry out quality checking.

The following procedure for sampling and sample evaluation is the method recommended by Promat for checking the mix quality of Cafco MANDOLITE® CP2. Any amendments or other methods of quality checking should be submitted to Promat in writing for evaluation.

12.9.1 Method of Sampling
During normal application procedure, the sample should be sprayed into two moulds without any alterations or sprayhead or machine settings (305mm x 305mm x 75mm mould size should be used). The moulds should be coated with a release agent prior to sample taking to allow for easy de-moulding after initial set.

The material in the mould should be equal to the depth of the mould. Any high spots should be removed with a cheese wire or cut with the edge of a trowel. The samples should not be tamped, vibrated or trowelled level.

12.9.2 Dry Bulk Density Determination
- Demould sample not less than 48 hours after initial spraying into mould.
- Weigh sample and record.
- Allow sample to condition at room temperature for a minimum of 7 days.
- Place sample in over at temperature of 50°C (in accordance with BS 8202 : Part 1 : 1995 Appendix B – Density Test).
- Weigh sample every 24 hours until three identical consecutive weights are obtained. The sample is then deemed to have reached equilibrium.
- Sample should be measured accurately using Vernier callipers and dimensions recorded.
- From the final dried weight and measurement of sample, the dry bulk density of the sample can be determined.
- For Cafco MANDOLITE® CP2 the dry bulk density should not be less than 331kg/m^3 for fire protective purposes.

13. Health & Safety

Health, Safety and Environmental information for our products is frequently reviewed and is available from Promat in the form of Safety Data Sheets (SDS's). Users of our products should make themselves familiar with the details contained in the SDS's, and on product packaging, before handling the products.

The information given in this manual is based on actual tests and is believed to be typical of the products. No guarantee of results is implied however, since conditions of use are beyond Promat's control.

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0605-PRO V1/03/2022

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