

Hempafire XTR 100

Application guidelines



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Index and appendices

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Disclaimer: The information in this Hempafire XTR 100 application instructions is a general guideline only based on controlled laboratory testing and practical experience. Hempel does not provide any guarantees with regard to the information in these application instructions. Hempel is not responsible for inaccuracies or typographical errors. The information contained in this document is uncontrolled if printed. The latest version is available on <http://www.hempel.com/en/product-list>



1.0 Introduction

The objective of Passive Fire Protection (PFP), is to protect equipment and structures from damage or collapse during a fire event. This is done by creating a physical barrier between the heat source and the structural element being protected. Without PFP on the structure, the structure loses integrity and might collapse which could escalate the fire.

The performance and long term durability (design life) of Hempafire XTR 100 is directly related to the surface cleaning and quality of the application of the system. Therefore surface preparation and application of any primers and topcoats should only be performed by experienced and trained labour with relevant knowledge of these activities. They should further understand the hazards and risks associated with these tasks, and understand the importance of a well prepared and documented task-based risk assessment.

The application of Hempafire XTR 100 shall only be applied by pre-qualified applicators in accordance with this instructions. Hempel's PFP field service technical department can provide onsite support to ensure compliance with this requirement.

2.0 Scope

These application instructions shall:

- provide sufficient information to enable the installer to correctly apply the Hempafire XTR 100 system
- define the requirements for surface preparation and inspection
- make reference to other codes and standards, and by reference will invoke the latest publication issue or amendments of the standard

3.0 System description

Hempafire XTR 100 is a two-component epoxy system reinforced with a fabric mesh. It can be applied by plural component spray or hand application.

Hempafire XTR 100 can be supplied in either 50 kg (110.23 lb) units for Plural machine application or 20 kg (44.1 lb) for hand application. For hand application, the component A pail is short filled to allow for mixing of both parts A and B together. The mix ratio is 2.55:1 in volume, and a ratio of 2.5:1 by weight.

Components	Pack size	Colour
Plural machine	Mix 50 kg (110.23 lb)	
Component A	2x17,9 kg (78.92 lb)	Black
Component B	14.2 kg (31.3 lb)	Grey
Hand application	20 kg (44.09 lb)	
Component A	14.3 kg (31.52 lb)	Black
Component B	5.7 kg (12.56 lb)	Grey
Hempafire Mesh 100	Small (57m ²), Medium (110m ²) Large (167m ²)	Black and white

4.0 Storage and shelf life

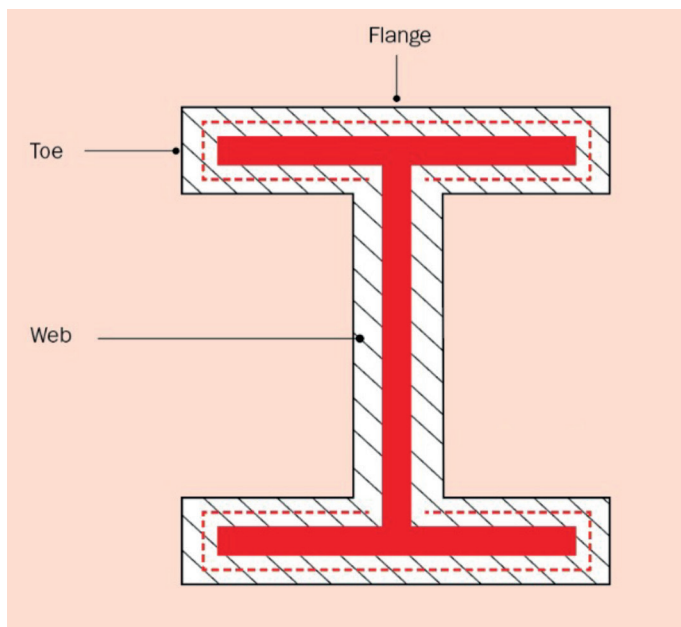
Please refer to Product Safety Data sheet for detailed information on storage and shelf life.

5.0 Reinforcement mesh and meshing design

5.1.1 Hempafire Mesh 100 is known as a multiaxial carbon/glass mesh. The mesh optimises fire performance by the strategical positioning during application. This positioning of the mesh enhances performance during a fire event. In all instances Hempafire Mesh 100 shall be installed at mid depth around the flanges of the specified thickness.

Note: Hempafire Mesh 100 is a proprietary mesh system and can only be purchased through the Hempel sales team. Use of other reinforcement systems is strictly forbidden, use of any other reinforcement other than Hempafire Mesh 100 shall invalidate all warranties and guarantees.

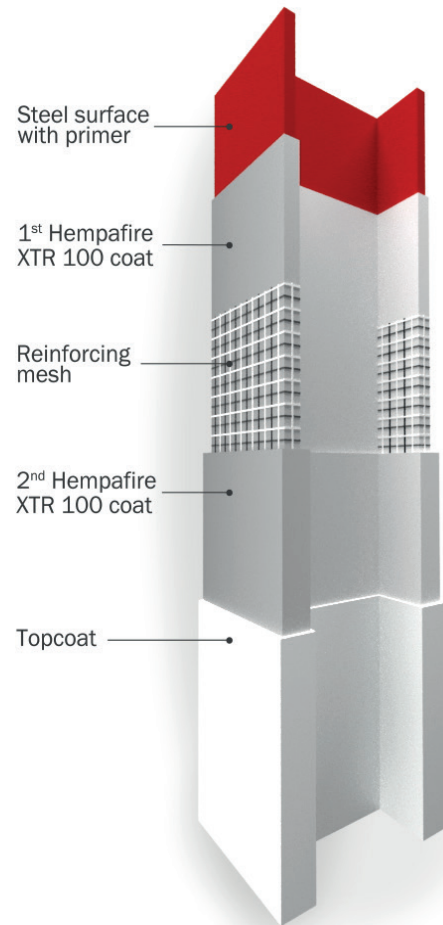
5.1.2 Meshing design:



For up to 4hrs protection UL 1709
 Flange face and edge reinforcement required. Applied over the flange toe and onto the flange face. Nominal overlap along the length 80mm/3inch.



Hempafire XTR 100



- Hempafire Mesh 100
- Hempafire XTR 100
- Steel Substrate

6.0 Pre-surface cleaning

Prior to surface preparation it is recommended that all steelwork is inspected for surface irregularities including weld spatter, undercutting slag, sharp or rough edges, burrs and laminations etc. All sharp edges should be ground to a minimum radius of 2 mm. Certain client specifications may differ in which case refer to Hempel Technical Support Team.

Note: No grinding of pressure components should be performed without written approval from the project engineer.

Any oil and grease contamination shall be removed in accordance with SSPC SP 1 solvent cleaning prior to blasting operations.

Note: Degreasing of austenitic stainless steels shall only be carried out using halide free solvents, pre-approved by the project engineer.

All compressed air used during the application shall be free of water and oil and verified clean in accordance with ASTM D4285. Adequate separators and water traps shall be provided. All water/oil traps, separators and filters should be cleaned regularly.

7.0 Surface preparation

The durability or 'design life' of Hempafire XTR 100 is directly related to the level of cleanliness of the surface that it is applied to, therefore the correct level of surface cleaning will be critical to the end performance of the system. The optimum method of surface preparation shall be dry abrasive blasting using an angular abrasive.

- 7.1 Steel surfaces shall be prepared to:
- ISO 8501-1, Sa 2½ NACE No2/SSPC SP10 (near white blast cleaning).
 - provide an angular surface profile of 50 - 90 microns.
 - the maximum allowable soluble salts levels when measured per ISO 8502-6 & ISO 8502-9 or SSPC guide 15 method B2 shall not exceed 80 mg/m² for carbon steel.
 - the substrate shall be checked for particulate contamination with the maximum level of contamination <2, and dust particle size <2 in accordance with ISO 8502-3 section 6.
- 7.2 Surface cleaning should not be carried out under the following circumstances:
- When the relative humidity is greater than 85%; or
 - When the surface temperature is less than 3 °C (5 °F) above the dew point temperature.
 - The air temperature is ≤10 °C (50 °F) or maximum 50 °C (122 °F).
 - Maximum substrate temperature is 55 °C (131 °F).
- 7.3 For stainless steel and galvanised surfaces Hempel's PFP technical department should be contacted for guidance.
- 7.4 Mechanical cleaning should be in accordance with SSPC SP 11 to provide a surface profile of >25 µm (1 mil). Mechanically cleaned surfaces shall be limited to small localised repairs only, generally in the region of <0.5 m² (5.38 ft²). Abrasive should be free from oil, grease or any other contaminant.

8.0 Primer

The primer should be applied in the manner recommended on the latest product data sheet of the relevant primer. However, should the product data sheets recommend or accept a higher film thickness than that which is recommended then the recommendations of these instructions shall take precedence. **Please refer to Hempel's primer approval list.**

Should the project specification differ from the instructions recommendation then it is recommended that the project engineer be informed of the requirements of these instructions.

- 8.1 Only pre-approved primers shall be used under Hempafire XTR 100.
- 8.2 The primer should have reached sufficient cure prior to overcoating with Hempafire XTR 100.
- 8.3 Strict adherence to the final film thickness shall be maintained. The method and standard to confirm compliance should be documented with the project specification however the following standards may be used:
- SSPC PA2: Procedure for determining conformance to dry coating thickness.
 - ISO 2808: (Method 10) Determination of film thickness.
 - ISO 19840: Measurement of and acceptance criteria for the thickness of dry film on rough surfaces.

Please refer to Hempel's primer approval list.

- 8.4 Stripe coating is recommended for welds, inaccessible areas and external angles. However where stripe coating is carried out on internal angles excessive film build should be avoided.
- 8.5 Factors which may affect the acceptance of the primed surface may include, but are not limited to:
- primer age - chalking may have resulted due to atmospheric exposure.
 - surface contaminants - resulting from other disciplines working in the same location.
 - amine bloom - due to exposure to inclement weather before fully cured.
 - excessive thickness.
 - damage to the primer coating should be repaired.

Note: Overlap areas are where the configuration of the substrate causes an unavoidable overlapping of the spray fan, typically at connecting angles and difficult to access locations.

- 8.6 Primers (excessive film build in the dry film). It is the responsibility of the Hempafire XTR 100 applicator to ensure that the primer thickness does not exceed the recommendations. **Please refer to Hempel's primer approval list.**

Should the primer thickness values be identified as being excessive, then the primer thickness should be reduced using the most appropriate methods available. In all instances burnishing and polishing shall be avoided as this may lead to an inadequate surface for Hempafire XTR 100 to adhere too. **For galvanised substrate, please refer to Hempel Technical Support team.**

9.0 Hempafire XTR 100 application

The most productive and commonly used method of applying Hempafire XTR 100 for large areas, is through a Heated plural component spray machine. There are a number of commercially available machines and it is not the intent of Hempel to promote one machine manufacturer over another. However, the Hempel PFP technical department can be contacted for a list of equipment which has demonstrated to be successful in the application of the Hempafire XTR 100 PFP system.

During application and curing of Hempafire XTR 100 it should be protected from the elements (rain, snow etc).

Furthermore during the application the following overcoating of Hempafire XTR 100 with itself should be followed.

Note: times may vary depending on air movement and humidity levels.

Temp	min	max
10°C	4h	1 week
25°C	3h	1 week
40°C	2h	1 week

For further guidance please refer to the technical note on Overcoating of Hydrocarbon PFP.

- 9.1 The equipment manufacturer should supply operating instructions for their specific equipment and where necessary provide training.
- 9.2 During pre-project start-up they should further advise on site specific requirements, i.e. power voltage and compressed air consumption rates.
- 9.3 The machine operating parameters in table 4 should be used to optimise the material application rates and maintain the materials characteristics during application. However, environmental conditions may determine the final values for optimising atomisation of the material.
- 9.4 The recommended spray lines sizes are:

Table 3	ID	Length
Part A:	18 mm (¾")	
Part B:	12 mm (½")	
Whip line:	12 mm (½")	4.5 m (15')
Tip size:	0,029" : 0.041"	

Note: Spray tip size and fan angle may vary depending on equipment and complexity of components to be treated.

- 9.5 Hempafire XTR 100 component A and B should be warmed to ~30°C (86°F) 24 hours prior to spraying. Furthermore prior to a production run a ratio check shall be performed to confirm the machine will meter the correct volumes of material. These ratio checks should be performed each morning, and/or after breakdowns, or should the machine not have operated within a 4-hour window. The machine manufacturer shall advise on the most appropriated method for the equipment. Hempel's recommendation is that independent of the equipment a ratio check should be performed under pressure at around 2000psi (ensuring all safety measures are observed). A quick guide for checking the weight ratio is outlined in section 10.0.

Table 4	Holding tank		In-line (bundle) heaters
	A	B	
Temperatures	45°C to 60°C (113°F to 140°F)	50°C to 65°C (122°F to 140°F)	60°C to 70°C (140°F to 158°F)
Pressures	2 to 5 bar (30 to 70 psi)	2 to 5 bar (30 to 70 psi)	N/A
Paddle speed (rpm)	14	14	N/A
Gun exit temperature			45°C to 60°C (113°F to 140°F)

It is recommended, temperature settings are kept at a minimum and increase slowly until satisfactory spray pattern is achieved.

Note: Overheating the material can affect the pot life and material properties.

Some modification of pressure and temperature may be required depending on environmental conditions and equipment used, e.g. Variable ratio equipment or fixed leg equipment.

- 9.8 Sample area or reference area
- 9.8.1 The standard of finish should be specified within the project specification. However, it's strongly recommended a sample area be completed.
- 9.8.2 The sample area should be of a suitable size and representative to the project and should remain accessible throughout the application.
- 9.8.3 The sample area should be witnessed and agreed by all contracting parties prior to going to full production.
- 9.8.4 All contracting parties should be in agreement to the level of aesthetics required and that the standard is to be maintained throughout the project.
- 9.8.5 The reference area should remain as a permanent reference to this agreement.
- 9.8.6 Should any ambiguity arise later in the project then the reference area can be referred back too.
- 9.9 The process flow chart in appendices A provides an outline to the basic process of the application. The following details shall offer guidance and should not be considered exhaustive.
- 9.10 Environmental conditions, prior and during application, shall be as per section 10.0.
- 9.11 Hempafire XTR 100 has been formulated to optimise the application characteristics and although it is possible to apply high film builds within a single application this method of application is not advisable.
- 9.12 Hempafire XTR 100 should be applied in a controlled process taking wet film thickness (WFT) readings progressively throughout the application.
- 9.13 Hempafire XTR 100 is 100 percent solids and therefore WFT will be the same as the dry film thickness (DFT).
- 9.14 A controlled application will minimise *waste overspray and decrease application times.
- 9.15 Team make-up
Hempel considers each member of the team as important as the next and the following list should not be considered in order of importance.
- 9.15.1 PFP supervisor - The PFP supervisor should have sufficient and continual development in the application of PFP materials and be considered competent in PFP application. Hempel considers competency as an auditable trail over a five (5) year period working with PFP materials. The PFP Supervisor should be able to organise each member of the team into their respective area of expertise. The PFP Supervisor should also be competent in occupational hygiene requirements for PFP materials and their application.
- 9.15.2 Machine fitter - The machine operative should be competent and proficient in the safe operation of the equipment in use. Competency may be demonstrated through training or assessment records either by the application company or the machine manufacturer.

Note: It is out of the scope of Hempel A/S to provide guidance on every piece of equipment on the market and therefore it is recommended that the machine manufacturer's own processes and procedures be followed, see section 9.1. Should a conflict exist between the recommendation in these instructions and the machine manufacturer's recommendation, then the Hempel PFP technical department should be contacted for guidance.

9.15.3 PFP sprayer - The spraying of PFP differs greatly to that of a more 'traditional coating', in that the sprayer must consider the application team that follow him. The PFP Sprayer should look to find the most productive method of spraying which keeps the whole team working. For projects with challenging geometries, spraying at a lower pressure will help control the application and by doing so will reduce the waste. The PFP sprayer should always take regular WFT checks progressively throughout the application and where possible, keep the gun at 90° to the surface being sprayed. The atomised (spray fan) material should be moved slowly across the surface, applying the PFP to the desired thickness. The spray fan should be overlapped by 50 percent to maintain a uniform application. Where a uniform application has been achieved then trowelling may not be needed. Should an uneven surface or fingering of the spray fan have resulted from the lower pressure, then the surface will need to be smoothed or flattened by trowelling.

9.15.4 Trowelling operative - The angle of the trowel should be sufficient to only smooth and flatten the surface. If the leading edge of the trowel is raised too high, it has the danger of removing or scraping off the material which has been applied. This may affect the film thickness and can result in rework due to low DFT. The aim shall be to provide a smooth, uniform surface, free from voids, to aid in the laying of the mesh and easing of the rolling process during meshing or final coating of the system.

9.15.5 Auxiliary operatives - The auxiliary operatives may be made up of a combination of 'roller hands' and 'mesh installers'. It is normal practice that these tasks are interchangeable to maximise production.

9.15.5.1 Reinforcement mesh - The mesh should be cut into predetermined sizes to minimise stoppages during spraying.

9.15.5.2 The mesh is laid into the Hempafire XTR 100 at mid depth and while the coating is still wet. Once laid in position, the mesh is lightly rolled using a short nap roller, to embed the mesh and knock down any peaks. The short nap roller needs to be dipped in solvent before to insure the paint is not sticking to it while rolling.

9.15.5.3 If it is known that a break in the application may take place, (>24 hours) then the mesh should be lightly sprayed with a 'flash coat' to encapsulate it. This encapsulation will protect the mesh from mechanical and environmental damage, and will leave the surface with a suitable key for future coats. Should the application be suspended >6 days then the Hempel PFP technical department should be contacted for guidance.

9.15.5.4 Roller operative - Rolling the final surface will improve the aesthetics of the applied system. Under certain circumstances a light 'textured' finish may be required. A 'textured' finish consists of spraying a light 'mist-type' finish over the surface. Heavy stippling should be avoided however the final finish should always be as per the agreed sample area see section 9.8 'sample area'.

Note: Solvent is normally required during application of Hempafire XTR 100, for that Hempel's Thinner 08450, 08570 may be used. Only Hempel approved thinners may be used. Any other thinners used will invalidate all warranties and guarantees.

10.0 Inspection and physical measurements

During the course of the Hempafire XTR 100 application, the following physical measurements shall be taken, see table 5.

10.1 Climatic conditions - Environmental reading should be as per section 7.2, 9.10 and table 5. The applicator should record all environmental readings within the Quality Control documentation. A minimum of three readings per day should be taken. The frequency of reading should be increased should climatic conditions start to reach the upper application parameters.

10.2 Ratio checks - The ratio check allows production spraying to start. However, the machines consumption or delivery of material should be monitored and recorded throughout the day's activities. A record of each unit or batch of material loaded into the machine should be recorded continually during spraying. Should the batch numbers change during the day's production, then the time of change should also be recorded next to the batch number. The recording of the batches provides a sense check that the machine maintains its ratio and allows for a degree of traceability for each batch of material that has been applied. The batch sheets and the ratio checks shall be retained at the end of the day's production, and appended to the daily coating reports.

10.3 Ratio check (by weight) - The following procedure is only relevant to ratio checks taken at the spray block. For ratio checks carried out directly at the machine dosing valves, the machine manufacturers specific instructions should be followed.

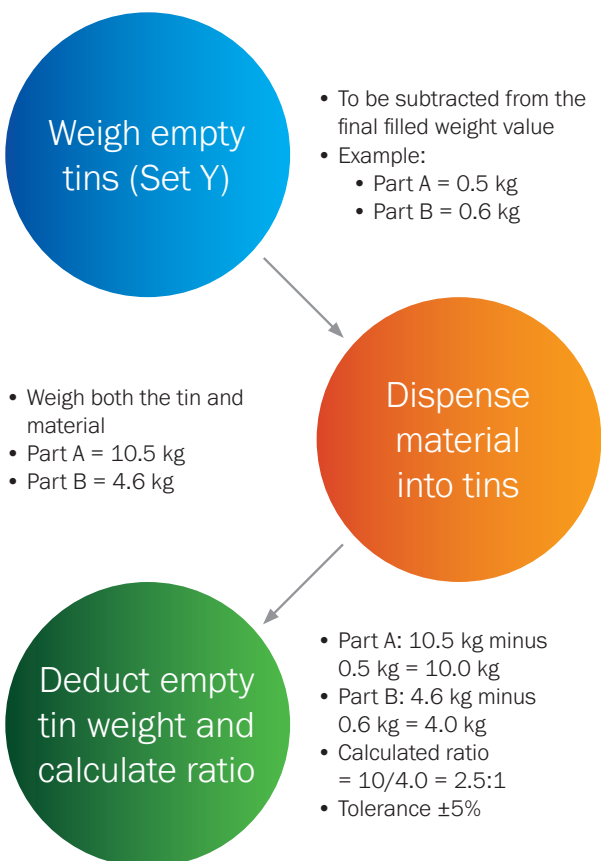
Please note: Hempel's recommendation is that independent of the equipment a ratio check should be performed under pressure at around 2000psi (ensuring all safety measures are observed).

10.3.1 The process requires four empty Hempafire XTR 100 tins. The four tins should be split into two sets, each set having two tins per set. The sets shall be known as X and Y. Set X shall be used to dispense or allow the material to flow freely before the assessment.

- 10.3.2 Both tins in set Y should be weighed and the value recorded.
- 10.3.3 Placing set X tins under component A and B lines, slowly start to dispense the material into the tins.

Note: Providing the tins are clean, the material may be reused.

- 10.3.4 Once the material demonstrates a constant 'free flow' the dispensing, or flowing material should be directed into set Y 'weighed' tins. The process needs to be executed on either side simultaneously and without interrupting the flow of material.
- 10.3.5 Once set Y tins are filled to about the halfway level, reverse. Remove the set Y tins and replace with set X. Again this should not interrupt the flow of material. Once the material flow is being dispensed back into the set X tins, the pressure to the lines may be reduced and the process stopped.
- 10.3.6 Taking set Y 'weighed' tins, deduct the weight of the empty tins from the weight of the tin and material.
- 10.3.7 Dividing the remaining weight of component A into the remaining weight of component B will give you the metered ratio by weight.
- 10.3.8 Ratio check example



- 10.4 Wet film thickness (WFT) readings:
 - 10.4.1 Wet film thickness measurements should be taken during the application. These readings will provide a guide during application that the project requirements are being met and will ensure that the required dry film thicknesses are achieved.
- 10.5 Visual assessment:
 - 10.5.1 The application should be continually assessed ensuring that the mesh has been correctly overlapped, and installed at mid depth, that there are no voids and the standard of application has been maintained as per the agreed sample area see section 9.8.
- 10.6 Dry film thickness (DFT) readings:
 - 10.6.1 The contracting parties should agree in advance on the method of inspection and type of gauge to be used. Individual dry film thicknesses of less than 80 percent of the target dry film thickness are not acceptable. Individual values between 80 percent and 100 percent of the target dry film thickness are acceptable, provided that the overall average (mean) is equal to, or greater than the target dry film thickness. Unless client specification states otherwise.
 - 10.6.2 Care shall be taken to achieve the nominal DFT and to avoid areas of excessive thickness.
 - 10.6.3 Over-application is not detrimental to the performance of Hempafire XTR 100, however it may have an impact on projects where the overall weight may be of concern. Additionally, over-applied material adds to the overall cost of the application.
 - 10.6.4 Hempel recommend two types of DFT equipment which are suggested to be used both:
 - a. Electromagnetic induction dry film thickness gauge - there are several suitable instruments available, and it is not the intention of Hempel to recommend one manufacturer over another. Once the Hempafire XTR 100 has sufficiently cured so the gauge probe does not indent into the surface of the PFP, then the gauge manufacturers instruction should be followed.
 - b. Pin or depth gauge with a sliding rule - this method of confirming DFT requires drilling a small hole of sufficient size to allow the pin on the gauge to penetrate through the PFP and touch the underlying substrate. Inserting the pin through the PFP, read the depth or thickness of the PFP on the slide rule. Care should be taken not to drill in to the substrate and all holes require filling with Hempafire XTR 100 once inspected.

The Hempel PFP technical department may be contacted for a list of suitable suppliers.

- 10.6.5 It should be recognised and understood that the surface of applied Hempafire XTR 100 will never be 100 percent smooth and the inspection may identify both low and high readings.
- 10.6.6 The project specification will identify the thickness requirements and these will be based on minimum requirement.

- 10.6.7 The calculated mean shall be equal or greater than the specified value.
- 10.6.8 Frequency of readings, as per ASFP TGN 003
 - 10.6.8.1 I sections, T sections, Channels and Webs: 2 readings per metre length on each face.
 - 10.6.8.2 Outer flanges: 2 readings per metre length on each face.
 - 10.6.8.3 Inner flanges: 1 reading per metre length on each face.
 - 10.6.8.4 Square/rectangular hollow sections and angles: 2 readings per metre length on each face.
 - 10.6.8.5 Circular hollow sections: 8 readings per metre length spread evenly around the section.

Table 5				
Type of test	Method	Frequency	Acceptance criteria	Consequence
Climatic conditions	Substrate, air temperature	Before, during and after application, a minimum of 3 times per shift, or greater when nearer maximum operating parameters	<85% RH >3°C (5°F) above the dew point >10°C air temperature	Application to stop
Ratio check	See section 10.0	Before start-up, after breakdowns or stoppages >4 hours	Metered ratio by weight 2.5:1 ±5%	Review machine settings Retake assessment
Wet film thickness (WFT) checks	Wet film comb or depth gauge	Continually through the application	Hempafire XTR 100 is a 100% solid material, therefore, WFT is the same as DFT	Over or under applied material
Visual examination	Check correct overlapping of mesh Check that mesh is installed at mid depth Confirm no visible contamination or defects Confirm no visible contamination Is representative of the sample area	After each coat and throughout the application	Project sample area Mid depth of the final specified thickness	Rework the areas until they are in compliance with sample area
Dry film thickness (DFT) checks	Confirm compliance to project requirements	See section 10.6	As per project requirements	Rework the areas until compliance has been achieved
Confirm final aesthetics as per sample area	Ambiguous situations refer to sample area	As necessary		

11.0 Topcoat

- 11.1 Hempafire XTR 100 has been tested and passed the environmental exposure conditions as set by UL2431 with the use of the topcoat. However, like all epoxies Hempafire XTR 100 may chalk or discolour after prolonged exposure. It should be stressed that discolouration or chalking will not detract from fire performance but may be seen as undesirable.
- 11.2 The final finish or top coat should be applied as soon as reasonably practicable after Hempafire XTR 100 application is completed, the coating has cured and the DFT has been checked, see product data sheet for more information. This is to avoid any inter-coat contamination and to maximise inter-coat adhesion. However, it is strongly recommended that the final coat should not be applied until the project contracting parties have accepted the application.

- 11.3 Hempafire XTR 100 with the current UL2431 certification can only be applied with a topcoat. The topcoat to be used is Hempthane 55210.

For further details please contact the Hempel PFP technical department for guidance.

Appendix A - Process flow

Area is released for application

- Agreed written communication.
- Substrate accepted.

Pre-heat PFP

- 24 hours prior to spraying.
- Sufficient material for a day's spraying.

Masking and sheeting, cut mesh to size

- Mesh to be cut to pre-measured sizes.
- Confirm all masking and measured heat transfers.

Ratio check

- Ratio check on machine.
- Confirm the machine settings and parameter are correct.

Record ambient conditions

- Confirm environmental conditions are within recommended parameters.
- Record results.

Apply first coat of Hempafire Mesh 100

- Apply first coat of PFP.
- Installing mesh.
- Check WFT.

Second coat

- Apply second coat to specified thickness.
- Check surface aesthetic is to project required.



Appendix B - Heat transfer and coatback

Text and drawings reproduced from FABIG technical note 13.

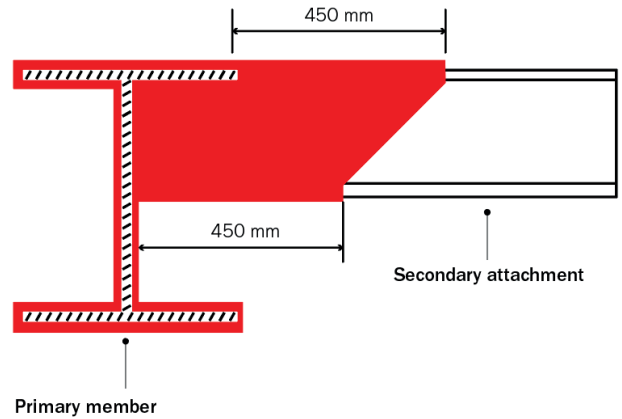
“Secondary and tertiary steelwork (e.g. bracing, deck stringers and equipment supports) and steel plate (e.g. decks or walls) which do not require PFP but are attached to protected primary structural steel are potential heat bridges. Flame impingement on these items can result in heat conduction reaching welded joints, causing a weakening of those joints and local heating of the primary structure which may reduce its fire resistance. The extent of this heating and the temperatures reached depend on the relative geometries of the primary member and the attachment”.

“Coatback is the extension of the PFP coating from the protected primary members along secondary, tertiary members or plate to limit local heating of the protected member at the attachment point and hence reduce the potential of premature failure”.

“Industry practice has been to apply coatback on all secondary members and attachments, including plate steel, for a minimum distance of 450 mm from the joint with a primary member or separating element being protected with PFP. The PFP thickness of the coatback is normally applied at the same rating as the primary steel member or divisional rating it is attached to; this simplifies application and inspection as it is generally not practicable to identify all connection combinations at design stage”.

“For small attachments such as brackets for cable trays, instrument piping and handrails, the cross sectional area will be small and the resultant heat transfer is not significant. Therefore, assuming these do not cumulatively exceed 3000 mm² cross sectional area per metre length of primary steel section or per square metre of surface area, then generally do not need to be coated”.

Due to the unprotected ‘secondary’ member having a potential to cause structural weakening at welded joints and localised areas etc, it is recommended that Hempafire XTR 100 be extended on to all secondary members by 450 mm (18”), to the same thickness as specified on the primary member. The exception shall be for small attachments: as per the above FABIG guidance on small attachments.

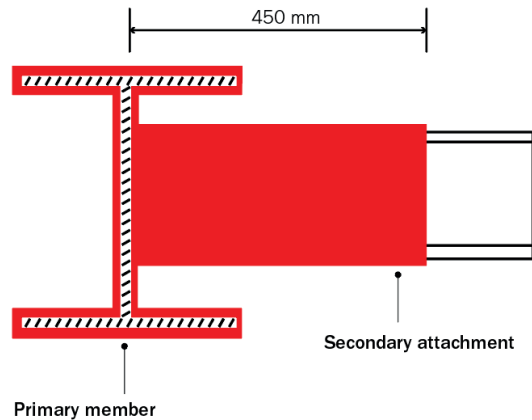


Primary member

Coating thickness based on section factor (A/V), fire type, fire duration and allowable critical core temperature.

Secondary attachment

Coating thickness same as primary member. Coating may follow profile of primary member or be finished off square.

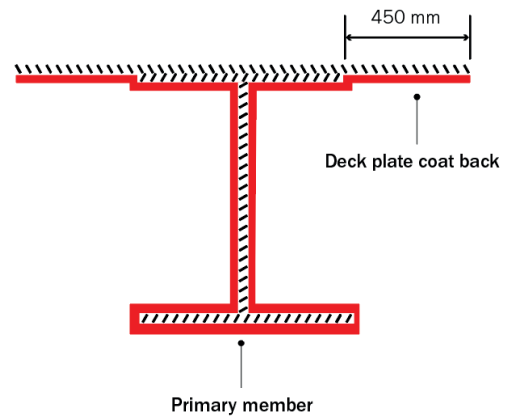


Primary member

Coating thickness based on section factor (A/V), fire type, fire duration and allowable critical core temperature.

Secondary attachment

Coating thickness same as primary member.



Primary member

Coating thickness based on section factor (A/V), fire type, fire duration and allowable critical core temperature.

Deck plate coat back

Coating thickness same as primary member.

Appendix C - Repair method

Overview

Hydrocarbon PFP may be required to be removed after cure for a number of reasons, i.e. the addition of supports or brackets, or if the system has been damaged from nearby welding activities or impact damage. In these instances, the following maintenance and repair guidance should be followed.

Procedure

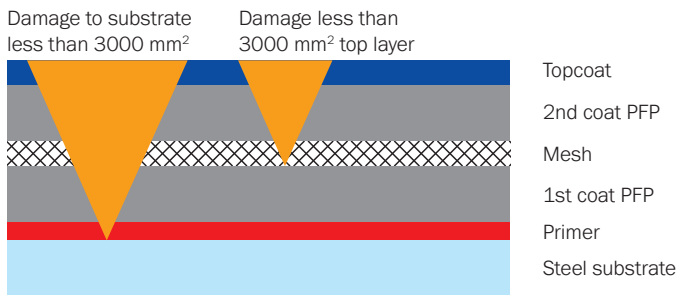
1. Phase 1: Inspection and Evaluation of the damage

First inspect the area of damage and evaluate which kind of damage it is.

Scenario 1: Surface damage

In certain instances it is not necessary to remove all the Hydrocarbon PFP to the steel substrate. These cases are the following:

- The Hydrocarbon PFP is only damaged at the surface but the area is less than 3000 mm² (e.g. small surface chips coming off, damage not reaching mesh, or surface layer charred above the mesh (Figure 1)).



- Hydrocarbon PFP that is damaged by a single defect, but the area is less than 3000 mm² and not on an edge or termination (flange tip or end of the HC protection on the structure) (Figure 1)

Figure 1: Showing a typical paint system including PFP and surface damages that can occur.

For the above cases follow repair procedure scenario 1 in Phase 2.

Scenario 2: Down to mesh or substrate damage

If the damaged area is larger than 3000 m² (Figure 2) and/or to steel substrate the procedure 2 mentioned in Phase 2 should be followed.

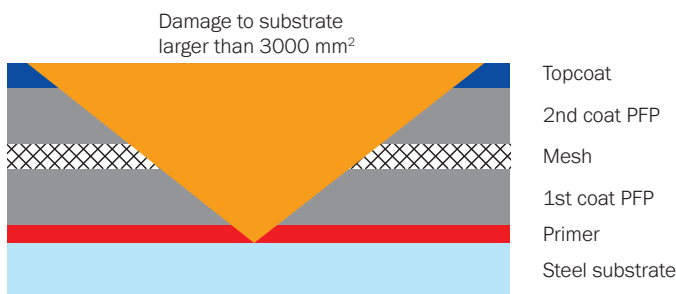


Figure 2: Showing a damage bigger than 3000 m²

2. Phase 2: Removal of damaged material and surface preparation

Procedure for Scenario 1

In the case of surface damage it is acceptable to only remove the damage/deteriorated PFP until reaching completely intact and adherend PFP i.e going to the depth of the damage. The outer perimeters of the repair area should be free of any finished paints systems, like topcoats etc. General rule is to remove old paint 150 mm from the edge of the damage to provide enough space for overlapping between old and new material. (Figure 1).

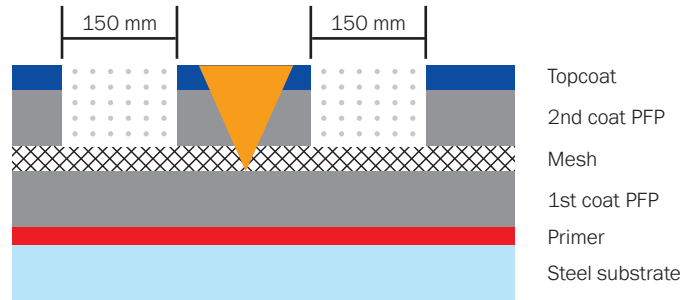


Figure 3: Make sure to remove paint 150 mm from the edge of the damage

The surface of the Hydrocarbon PFP must be clean, dry and free from contaminants. Then the Hydrocarbon PFP should be sanded to roughen the surface. New material can be applied following phase 3 guidelines. See below.

Procedure for Scenario 2

2.1. Small areas

For smaller areas remove material with careful use of a hammer and chisel, the Hydrocarbon PFP may be cut back, taking off the edge. With the chisel directed away from the body strike the chisel with the hammer with sufficient force to remove the material. Once a 'feel' for the material has been gauged, it will be possible to either increase or decrease the force required to remove the PFP. Care should be taken not to damage or score the substrate.

2.2. Large areas

For larger areas where hand tools may not offer sufficient productivity, then a pneumatic chisel can be used. It should be noted that pneumatic chisels can be very labour intensive and can be governed by local regulations for hand and vibrating arm syndrome (HVAS). It should further be noted that pneumatic tools are more likely to cut and score the substrate when used.

The outer perimeter of the repair area should be free of any finished paint systems. Any topcoats need to be removed and the surface abraded to a distance 150 mm to provide a key for subsequent overlapping of material like in Figure 3 demonstrated.

Once the Hydrocarbon PFP has been removed the underlying surface should be cleaned and re-primed following the surface preparation guidelines below and then apply the Hydrocarbon PFP following the guideline outlined in Phase 3 Scenario 2:

2.3. Surface preparation

2.3.1. Cleanliness

- Remove oil, grease and other contaminants by suitable detergent cleaning.

- Remove salts, detergents and other contaminants by high pressure fresh water cleaning.
- Abrasive blasting to min. Sa 2½ (ISO 8501-1) / SP 10 (SSPC).
Roughness
- Surface profile Medium (G) (ISO 8503-2) / Rugotest No. 3 BN10a-b / Rz <75 microns (2.4mils)

2.3.2. Mechanical cleaning

Mechanically cleaned surfaces shall be limited to small localised repairs only, generally in the region of 0.5 m^2 (775 inches²) and shall be cleaned in accordance with SSPC SP 11 to provide a surface profile of >25 µm (1 mil).

2.3.3. Application of primer

After surface preparation of the damages area apply the specified primer to the specified DFT required by the project.

3. Phase 3: Application of new material

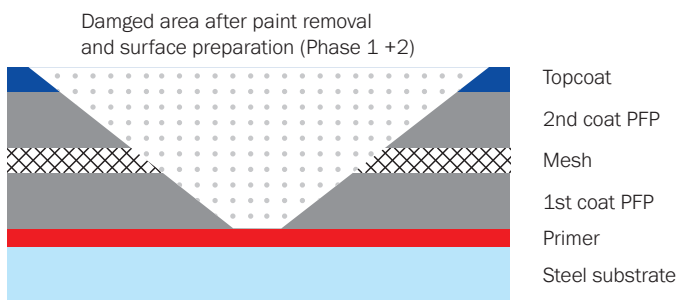
Scenario 1: Surface damage

Once surface preparation of the damaged area has been completed, application/repair of the area can take place. Prior to commencement, the perimeter of the area should be masked with tape. Using small hand tools i.e. a plastering trowel and gauge, the first coat should be applied to the specified thickness.

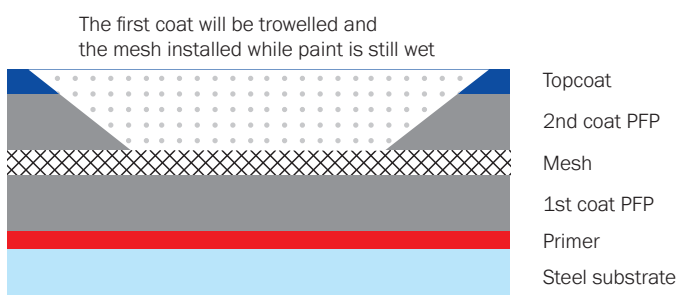
Scenario 2: Down to mesh or substrate damage

Where the damages are larger than 3000 mm² and/or reach the steel substrate, the whole coating systems as specified needs to be reinstated. Therefore the Hydrocarbon PFP requires depending the product a first coat, mesh installation at mid depth and application of a second coat.

If this is the case the first coat is applied as by specification,

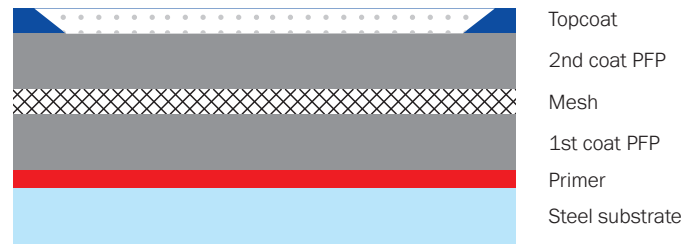


then while the hydrocarbon PFP is still wet the mesh should be laid into the applied material as per specification and rolled smooth.



Once the material has sufficiently hardened to support an additional coat, the second layer can be applied. The second layer should be applied to the required final thickness, overlapping on to the masking tape.

Further and final coats are installed of the hydrocarbon PFP to the specified thickness making sure the edges of old material are thoroughly wetted by the new material



The surface should then be rolled smooth after the masking tape is removed while the material is still workable.

On completion and after the final inspection, the topcoat can be reinstated as specified. The topcoat should be blending into the previously installed material, ensuring that the old topcoat is clean, dry and free of contaminants before overcoating it.

Appendix D - Abbreviations and definitions

Abrasive cleaning

Abrasive cleaning, or 'grit-blasting' is a process of removing millscale or other surface contaminants while producing a surface profile. This is achieved by impacting the substrate using high-velocity abrasive particles.

Competency

The combination of observed and measurable knowledge, skill, ability to perform specific job functions to identifiable procedures.

Dry film thickness (DFT)

The thickness of cured film, coating, or membrane.

Hempafire XTR 100

A fire mitigation system tested and certified against a time/temperature test curve based on a hydrocarbon material fuel source. Tested in accordance with UL 1709 standard.

Intumescent coating*

A fire protection material which functions by expansion on exposure to heat to form an insulating layer, thereby protecting the substrate.

Passive fire protection (PFP)

A barrier coating, or other safeguard which protects against the heat from fire without additional intervention. (Replicated from API 2218 section 3.8 third edition).

Primer*

A protective coating, usually anti-corrosive, designed for application to suitably prepared metallic substrates.

Surface profile

The irregular peak and valley profile on the surface of bare metal that results from abrasive blast cleaning or power tool cleaning.

Wet film thickness (WFT)*

The wet film thickness of a coat immediately after application.

Wet film thickness gauge*

A comb-like gauge with indentations of pre-determined depths used to measure the wet film thickness of a coat during application.

* Replicated from ASFP TGN 003

Appendix E - References

Type of test	Method
ASTM D4285:	Standard test method for indicating oil or water in compressed air
ASFP TGN 003:	Technical guidance note for the measurement of dry film thicknesses (DFT's) for intumescent coatings
FABIG TN No 13:	Fire loading and structural response
ISO 8501-1:	Visual assessment of surface cleanliness
ISO 8502-3:	Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
ISO 2808:	Determination of film thickness
ISO 19840:	Measurement of, and acceptance criteria for, the thickness of dry film on rough surfaces
NACE 2/SSPC SP10:	Joint standard for near white metal blast cleaning
SSPC SP 11:	Power tool cleaning to bare metal
SSPC GUIDE 15:	Field methods for retrieval and analysis of soluble salt on steel and other nonporous substrates
SSPC PA2:	Procedure for determining conformance to dry coating thickness
UL 1709:	Rapid rise fire test of protective materials for structure steel
UL2431	UL Standard for Safety Durability of Fire Resistive Coatings and Materials

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