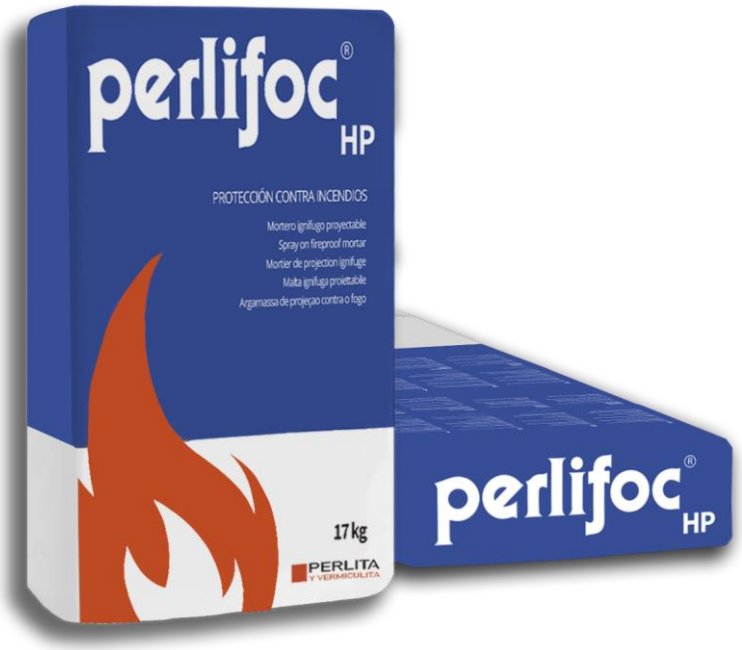

APPLICATION GUIDELINES

PERLIFOC HP

It is a fireproof mortar for passive fire protection.

It is applicable on steel structures and flat concrete profiled sheet composite elements

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APPLICATION GUIDELINES **PERLIFOC HP**

All values and guidelines included in this document are approximate and non-binding in general terms. The user must consider that these instructions rely on the cautions and good practices that must always be observed during the application process, under any circumstance. These instructions rely as well on the compliance with the instructions detailed in our Product Data Sheets (PDS). The performance data included herein comes from laboratory tests, and therefore, in real application conditions, the final product performance may change significantly depending on the weather and application conditions. The user must always verify the product suitability for each specific use, and follow all guidelines and instructions for the use of the product. The user shall be held fully and solely responsible for any implied liability resulting from the use of the product. Perlita y Vermiculita, S.L.U. reserves the right to change the content of this document. The partial or total publication of these instructions is strictly prohibited without Perlita y Vermiculita, S.L.U. previous consent.

TECHNICAL DATA /PRODUCTION

It is a gypsum based fireproof mortar, fire resistant, with thermal insulation properties for passive fire protection.

PERLIFOC HP is made out of lightweight aggregates and expanded materials, hydraulic binders, setting controllers and additives to improve its mechanical application. It does not contain asbestos.

The manufacturing process of PERLIFOC HP complies with ISO 9001 and ISO 14001 standards. It is supplied in bags of 17 kg, with a total of 48 bags per pallet (816 kg). Due to its physical features, once a PERLIFOC HP bag is opened, it has to be used entirely in that moment; it cannot be closed, stored, and used afterwards, not even for short periods. The theoretical coverage rate of PERLIFOC HP is 4.1* kg/m^2 at 1 cm.

*NOTE: Values obtained under laboratory conditions

Picture 1 (Sprayed mortar on industrial warehouse)

APPLICATION

The PERLIFOC HP mortar disposes of CE marking for two different solutions, protection for steel structures and flat concrete profiled sheet composite elements.

1) Surface Preparation

PERLIFOC HP must be applied only on thoroughly clean surfaces.

Surfaces must be free of any contaminant agent or any particle interfering with the adhesion of the product. The substrate must be free of dust, wastes of oil, grease, paint remover leftovers, fragile and/or unsticking materials, old plaster layers, and old paint or water-repellent layers. When the adherence of the substrate cannot be guaranteed, a mesh or an adhesion promoter can be used to ensure a correct application.

Application on steel: PERLIFOC HP's adherence to this substrate is excellent (primed or not), and in general to all the metal surfaces always they are perfectly clean; therefore, before applying the product clean the substrate thoroughly. Remove any dust or rust from the substrate. In case there is a previous plaster layer, it is recommended a pressure washing using high-pressure water equipment, or a mechanical brush, after this, to achieve a perfectly clean result, sandblast the surface or treat it with a similar process. For beams and pillars more than 500 mm wide, the use of a mesh attached to the lower flange is recommended. Moreover, the use of a mesh is also recommended when the application is necessary only on one side of the profile or on square or circular sections or on profiles that are subjected to significant deformation.

Application over galvanized steel (profiled steel deck): PERLIFOC's adherence to this substrate is excellent, and it does not require any adhesion promoter. The substrate must be free of dust, wastes of oil, grease, paint remover leftovers, fragile and/or unsticking materials, old degraded plaster layers, and old paint or water-repellent layers. When the adherence of the substrate cannot be guaranteed, a mesh or an adhesion promoter can be used to ensure a correct application.

In some cases it is recommended the use of a mesh or an adhesion promoter to ensure a correct adhesion to the substrate. For further specific information about this, and in case of doubts regarding the preparation of the surface, contact Perlita y Vermiculita, S.L.U. Technical Service.

Concerning the compliance with these guidelines, the user will be responsible for the evaluation of the substrate, and for gathering the required conditions for the correct application of PERLIFOC HP mortar.

2) Application Procedure

PERLIFOC HP mortar can be applied on different types of substrates in one or more layers according to the total thickness required. **In particular:**

a. **For thickness levels up to 30 mm:** a single mortar coat can be applied until reaching the required thickness level.

b. **For thickness levels over 30 mm:** recoating works using PERLIFOC HP requires that the previous coat must still be wet, the second coat must be applied during the next 24 hours, and waiting a minimum interval of 2-3 hours (the same time intervals should be respected for added layers). Any coat can not be more than 30 mm thick. The first coat must provide a uniform layer covering the entire surface, it must be perfectly attached to the substrate, and it has to be applied providing a homogeneous profile for the next coat. The recoat approximate time must be set considering the ambient conditions (temperature, humidity, wind…), and the operator's experience

   The user must apply PERLIFOC HP after cleaning and preparing the surfaces following the instructions in section 1 of this document. The ambient temperature must be between 3°C and 30°C and the substrate temperature must be at least 3 ºC above the dew point.

NOTE: Verify frequently the amount of water for the mixture. The values of water supplied are described in the next section.

3) Application Equipment

PERLIFOC HP mortar can be applied using a mixer pump with continuous-speed motor (220 V, or 380 V) like PUTZMEISTER MP 25 (picture 1) or similar, or a mixer pump with variable-speed motor (220 V, or 380 V) like PUTZMEISTER S5 (picture 2). The pumps must include a loading area (inclined or vertical) from the hopper to the mixing chamber, and a helical mixer with double blade to ensure the entrance of the product in the mixing chamber and to obtain a homogeneous mixture.

Picture 2 (Continuous spraying machine)

Picture 3 (Discontinuous spraying machine)

The spraying machine must be provided with the accessories supplied by its manufacturers and suitable for the required use.

Furthermore, the following elements are required:

a. **Helical mixer** for fireproof mortars (Picture 4).

b. **Jacket (stator)** for fireproof mortars (Picture 5). At least of 25 l/min.

c. **Rotor** suitable for the jacket (Picture 5)

d. **Nozzle** of 12 mm of diameter (picture 6). It is possible to reduce the diameter of the nozzle to 10 mm.

e. **Ball valve** for the injection lance (picture 7). Keep the hose pressurized closing the ball valve right after the interruption of the air flow, this way the material does not get blocked at the nozzle every time the work restarts.

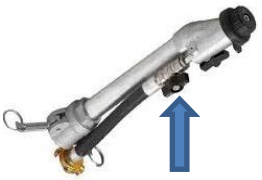
f. **Maxi turbo (optional)**: while the equipment is spraying the mortar, the turbo eliminates the air blockages, speeds up the material flow, and improves the application of the product (picture 8). The use of a turbo requires a longer rotor with tang (picture 9).

g. **The flow meter**: The use of a flow meter of at least 0 to 600 l / hour is recommended.

Picture 4

Picture 5

Picture 6



Picture 7

Picture 8

Picture 9

Cautions must be taken into account to improve the use of the mortar pump and minimise the margin of error while PERLIFOC HP is being sprayed.

These are the most important cautions to be considered:

1. In order to ensure the total efficiency of the equipment, the user must check the following practices: if the equipment is going to be stopped for more tan 30 minutes, clean the water filters, the hose, and the jacket. Clean also the hose and the jacket right after each use.

2. It is recommended lifting up the edges of the hopper to improve the loading of the mortar, and to minimise the risk to empty the mixer (this would reduce the mortar consistency).

3. To correct the consistency of the mortar before the application, and to collect the material coming out of the nozzle once the airflow has been turned off, keep always a container or a bucket next to the injection lance. After each application, do not leave the injection lance full of material without airflow in the bucket. This caution is necessary to prevent the mixed material from getting inside the air hose.

4. It is possible using a turbo with a compatible rotor to the spraying machine.

5. The recommended airflow pressure must be between 4 and 5 atm (58.8 and 73.5 psi).

6. The water supply to be used in continuous mixers must be between 550 and 650 l/hour (this water amount equals approximately to the range 13.5-17 l per bag when using a discontinuous mixer). The water flow could vary depending on the type of substrate, the ambient conditions, the distance with the substrate and the substrate height, and above all, on the operator's experience and practice.

7. For the application in steel structures, it is recommended to use at least of 25 l / min stator and 12 mm and 10 mm nozzles in case of thin thickness and finer finishes.

8. The use of pipes/hoses with different sections (internal diameters) may cause problems in the material flow and the product consistency. If possible, the hose must be undivided; if it includes joints, they must continue the same I.D. The hose from the pump to the injection lance cannot be more than 25 m long.

The mortar must be applied keeping the mortar injection lance at right angles to the surface and at 30 to 40 cm from it (Picture 10).

Picture 10 (Mortar spraying detail)

FAILURES AND POSSIBLE CAUSES

During the application of PERLIFOC HP, some problems may arise in certain situations that may results in non-conformities.

The following table shows the main possible failures and their causes.

FAILURES	POSSIBLE CAUSE
Application of a single layer (up to 30 mm): cracking after application	It occurs especially when the thickness of the sprayed layer is excessive; or in the case that the base surface is absorbent and has not been moistened prior to the application of the PERLIFOC HP. Another possible cause is excessive air flow.
Application of more layers (final thickness greater than 30 mm): cracking in the 1st layer after application	The probable cause described above, will disappear with the application of the following layers and will not have any impact on the good behaviour of the product.
Lack of adhesion between the following layers of applied mortar.	A probable cause is not respecting the curing time as mentioned in section number 2: wait at least several hours between the layers, but without exceeding more than 24 hours. Another possible cause may be excessive thickness applied in the last layer
Loss of adhesion of the mortar layer during application, and immediate release of the surface	It usually occurs when the amount of water used is not adequate for the amount of mortar used. It is will be suitable to adjust the amount of water recommended, although it will depend on the experience of the applicator and the environmental conditions of application. Another possible cause can be an excessive thickness applied. Finally it could be caused because the substrate is not clean and prepared as indicated in section number 1.

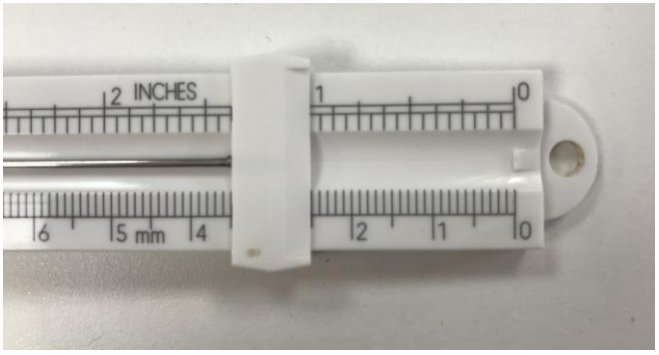
Contact Perlita y Vermiculita, S.L.U. Technical Service to find the best solution to each failure that may arise when applying PERLIFOC HP mortar.

MEASURING AND APPLICATION COMPLIANCE

Monitoring the application starts with the product selection. This implies that, in order to control the application, the user must verify the thickness level of the protection coat, based on the project requirements, and on the results of the product tests. A specific thickness level will be specified and it will vary depending on the element and surface to be coated, and on the required fire-resistance rating.

Once the measuring areas have been selected, it is possible to measure the applied mortar dry thickness using a gauge (pictures 11 and 12) that penetrates in the mortar and marks the thickness in a graded scale. A calibre can also be used for the same purpose.

Picture 11 (thickness measure gauge)



Picture 12 (thickness measuring example: 25 mm)

Note: The recommendations included in this document are not binding. However, our recommendations are not exclusive to any practice that the operator may consider necessary from his experience and good practice, or to the specifications set in our Product Data Sheets.

For further information and queries, contact Perlita y Vermiculita, S.L.U. Technical Service.