ecoHPC+
High Performance Coating

TECHNICAL GUIDE

SPECIFICATION ON CATAPHORESIS TREATMENT

TOP CLASS IN COATING

CleanAir

03

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Summary

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Introduction

Metal surfaces treated with Cataphoresis get a high resistance to atmospheric agents.
Being an immersion treatment combined with electric energy, due to electrodeposit, gives a very high resistance to corrosion to the most inaccessible parts of the products such as housings, deep bends and couplings, contrary to traditional spray application methods.
Cataphoresis treatment is widely used in various fields – automotive, tractors, air-conditioning, heating and industry and domestic appliances.

Definition

Electrophoretic deposition (EPD), is a term for a broad range of industrial processes which includes electrocoating, cathodic electrodeposition, anodic electrodeposition, both included in the electrophoretic coating, or electrophoretic painting. A characteristic feature of this process is that colloidal particles suspended in a liquid medium migrate under the influence of an electric field (electrophoresis) and are deposited onto an electrode. All colloidal particles that can be used to form stable suspensions and that can carry a charge can be used in the electrophoretic deposition. This includes materials such as polymers, pigments, dyes and metals.
The process is useful for applying materials to any electrically conductive surface.
The materials which are being deposited are the major determining factor in the actual processing conditions and equipment which may be used.

Chapter 2: Uses:

This process is industrially used for applying coatings to metal fabricated products. It has been widely used to coat automobile bodies and parts, tractors and heavy equipment, electrical switchgear, appliances, metal furniture, beverage containers, fasteners, and many other industrial products.

EPD processed have a number of advantages that have made such methods widely used:

1. The process applies coatings that generally have a very uniform coating thickness without porosity.
2. Complex fabricated objects can easily be coated, both inside cavities as well as on the outside surfaces.
3. Relatively high speed of coating
4. Relatively high purity
5. Applicability to a wide range of materials (metals and polymers)
6. Easy control of the coating composition.
7. The process is normally automated and requires less human labour than other coating processes.
8. The aqueous process which is commonly used has less risk of fire relative to the solvent-borne coatings that they have replaced.
9. Modern electrophoretic paint products are significantly more environmentally friendly than many other painting technologies.
10. Resistance against physical chemical aggression
11. Greatly reduced the quantity of waste material

Food & Beverage

Metal furniture

Appliances

Heavy equipment

Automotive

Chapter 3: Cycle of Caraphoresis treatment

First cycle

Cages are cleaned and degreased in the first four tanks with the aid of nanotechnology, in baths of water and sodium hydroxide at a temperature of 50/60°C for about 15 minutes.

Second Cycle

The residues are removed from the surface in two phases, soaking the supports for filter bags in tanks 5 and 6 with demineralized water H2O and other solutions:

- Water with ambient temperature
- Electrical conductivity <50 mS/cm (microsiemens/cm)
- 30% sodium hydroxide solution
- Hydrochloric acid
- Nanotechnological treatment

Third cycle

(Electrocoating)Electrolytic coating comprises in thank 7:

- 10% solid of a mix of pigment paste and epoxy resin in demineralized water
- Bath temperature 31/32 °C
- Voltage supply 180 V

Forth cycle

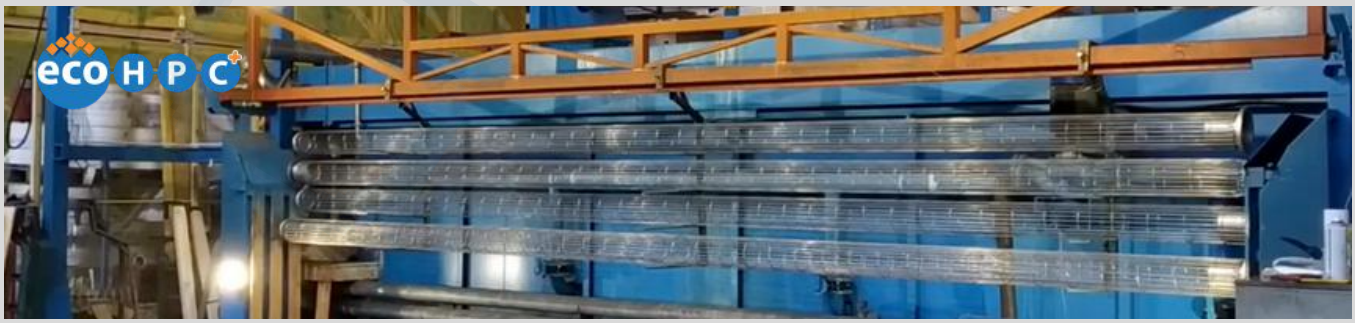
Final cleaning of the support for the sleeve (washing coating) and rinsing in 8 and 9 tanks for 5 minutes and a draining wash for 8 minutes.

Fifth cycle

The paint dries in an oven at 160°C for about 30 minutes.

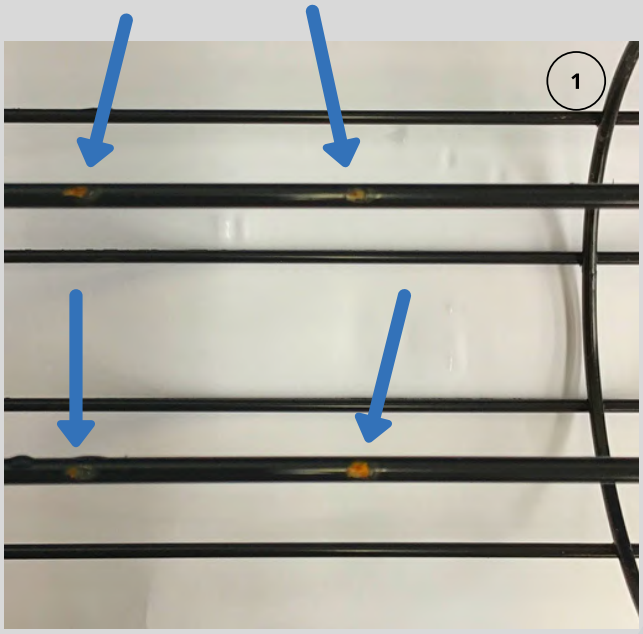
End of cycle

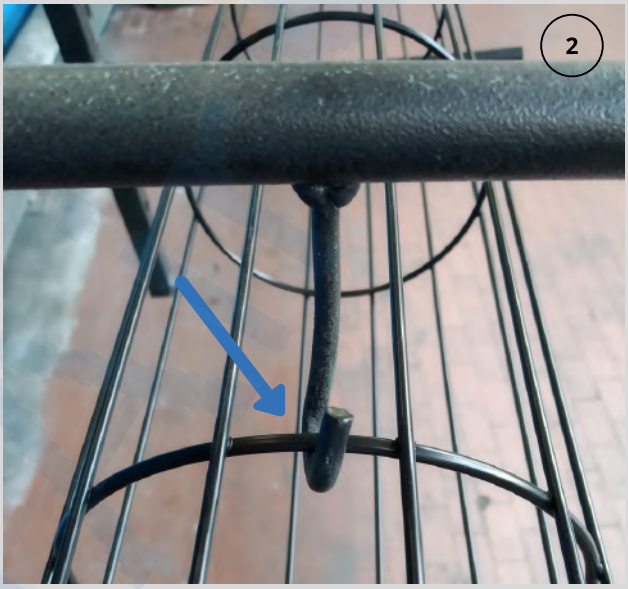
Cages are placed straight into the crates ready for shipment.



Chapter 4: Technical Characteristic of EcoHpc Plus

On the surface of the cage, some points may not be completely covered (1) due to the industrial process (2) but, thanks to the characteristic of the EcoHpc Plus process (cataphoresis process), the rust can't spread out. (See spray test on page n.07)



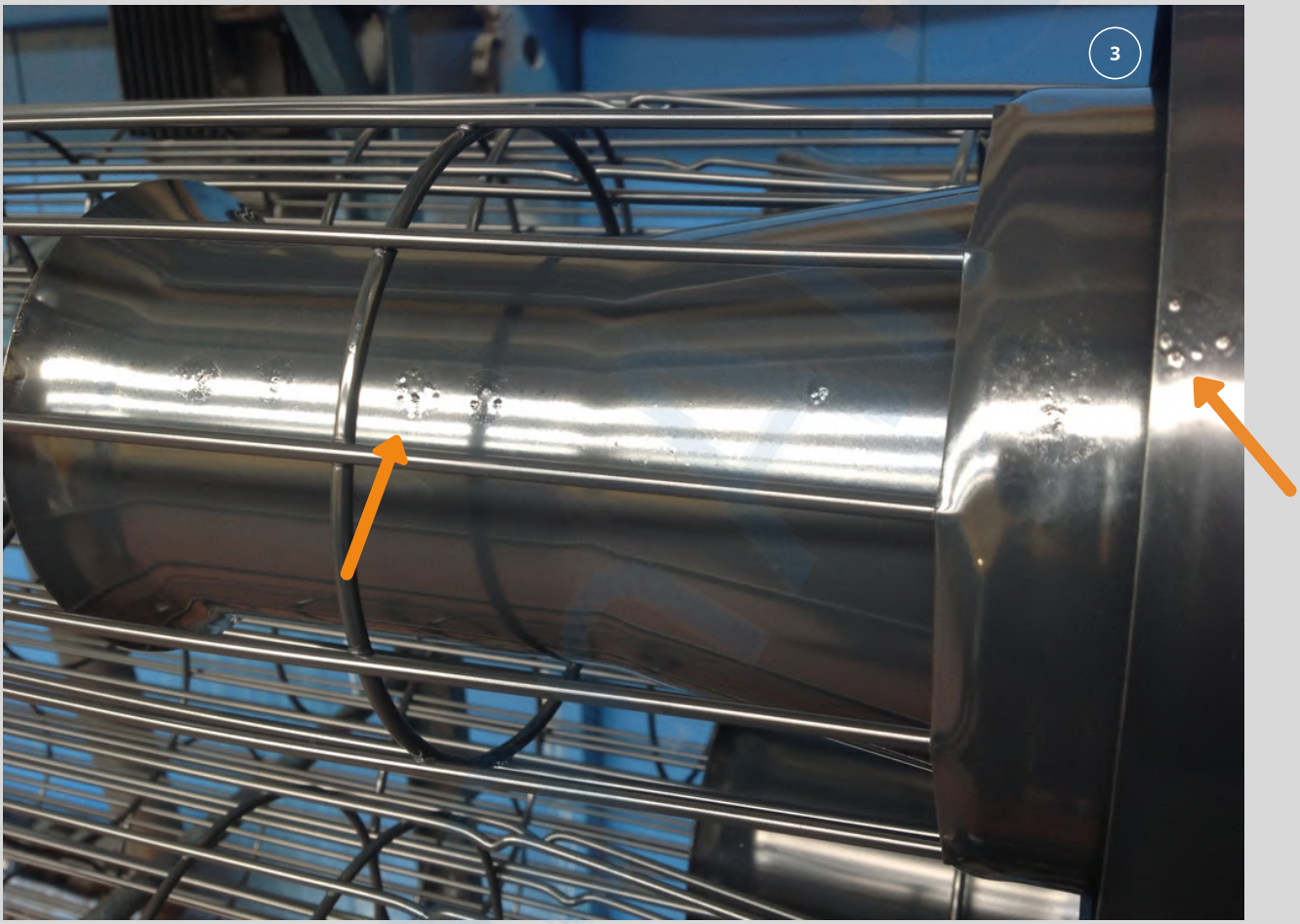


Stresses during transport

The overlap of the baskets during transport can be subjected to stress and create rubbing and some scratches between cages but the characteristic of the EcoHpc Plus process (cataphoresis process), will help to prevent the spread out of rust. (See spray test on page n.08)

Chapter 4.1.: Technical Characteristic of EcoHpc Plus

The surface of some components may not be completely smooth due to the characteristic of the raw material. It's only an aesthetic feature and not a technical problem that could damage the bags. Most of these points are not in direct contact with bags ( ) 3



Chapter 4.2.: Technical Characteristic of EcoHpc Plus

The EcoHpc Plus and in general all the cataphoresis treatments under the UV or left outdoor, could lose the brightness and become matt. If this happens, the technical characteristic of the product does not change (4)

New coated cage

Reduction of the gloss of the paint

Chapter 4.3.: Alteration of color under uv rays

The colour on the welding points (between bars and rings) could change under the UV or during the time: if this happens the technical characteristic of the treatment does not change

Chapter 4.4.: Instructions on how to store the crates

The outdoor storage can change the characteristics of the cages and on every single crate.
We clearly underline not to expose to the weather condition (see stamps on the wooden crate)
The yellow and blue polyethene with which the crates are wrapped is resistant to UV rays.

"CleanAir Europe Srl is not liable for damages caused by this specific incorrect use".
In order to preserve the filter bag cages during the storage according to the warranty condition, customers have to follow carefully the CleanAir Europe Srl handling and storage manual instruction available on request.

Chapter 4.5.: Resistance of ECO Hpc Plus to main chemical agents

Many different parameters could affect and impact the resistance of ECO Hpc Plus to chemicals. In general resistance to chemicals is lowering with increasing temperatures. Humidity and the contemporary presence of multiple gases could impact the lasting of the treatment. In normal conditions, the following table reports a qualitative response to chemicals.

A four-star ranking Legenda below, express tolerance of Eco Hpc Plus to the chemicals agents

To avoid ★

Fair ★★

Optimal ★★★

PARTICULATE MATTER 30	mg/Nm3	★★★
PARTICULATE MATTER 5	mg/Nm3	★★★
CADMIUM, THALIUM AND THEIR COMPOUNDS	mg/Nm3	★★★
ANTIMONY, ARSENIC, LEAD, CHROMIUM, COBALT, COPPER, MANGANESE, NICKEL, VANADIUM AND THEIR COMPOUNDS	mg/Nm3	★★★
HYDROGEN CHLORIDE	mg/Nm3	★★
HYDROGEN FLUORIDE	mg/Nm3	★★
SULFUR DIOXIDE	mg/Nm3	★★
OXIDES OF NITROGEN	mg/Nm3	★★★
CARBON MONOXIDE	mg/Nm3	★★★
AMMONIA	mg/Nm3	★★★
TOTAL ORGANIC CARBON	mg/Nm3	★★★
PCDD/F1	Ng I-TEQ/Nm3	★★★
PCDD/F+DIOXINE LIKE PCBS1	Ng Who-TEQ/Nm3	★★★
MERCURY AND ITS COMPOUNDS	Microg/Nm3	★★★

Chapter 4.6.: Resistance of ECO Hpc Plus to temperature and heating.

As previously informed, ECO Hpc Plus is well resisting a continuous temperature of 200 °C.

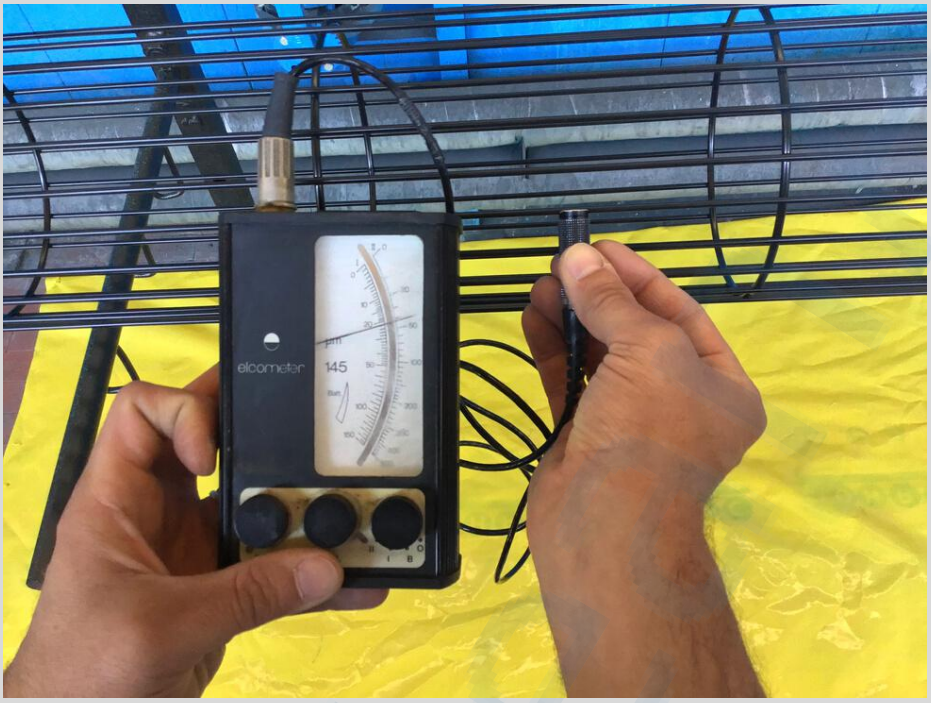
At 250°C, the Eco Hpc treatment will continue to work and protect steel with a loss of 3 microns in thickness.

The thermic conducibility of a 20 micron ECO Hpc Plus is about 0.39 W/m/K (TPS method), so ECO Hpc Plus is not keeping heat and does not cause or maintain or maintain overheating with respect to nude cage steel.

Chapter 5: Chemical and physical test

- Thickness microns: 12-30 microns
- Resistance to salt spray chamber: below 4 mm on iron phosphates at 1200 hrs
- Resistance to water according to ISO 1521
- Resistance MEK: after 40 double rubs, clean the control pad
- Bending with spindle: no leaks (spindle 10mm diameter)
- Resistance to high temperature for a long period of 200° with maximum peaks of 240°
- Paint hardness: 5H+

Example of thickness test which gives a result of about 21 microns (>12 microns)



Chapter 6: MEK test:

Method to verify the paint reticulation of the support through a solvent, the methyl ethyl ketone. The test consists in soaking a methyl ethyl ketone cotton wad and run 40 passes back and forth on the painted surface, in case the surface of the support shows a colour alteration and the wad will be the colour of the paint present on the support it means that the varnish hasn't reticulated to the surface.

Mek testing tools: methyl ethyl ketone, painted support, cotton wad

Clean control pad

Example of resistance after 40 double passages

Chapter 7: Salt spray test

Salt spray tests are carried out to check the resistance of a material or a coating to the corrosion process which is triggered naturally with the reaction (chemical or electrochemical) to the aggression of oxidising agents such as, for example, atmospheric oxygen, moisture, gas, corrosive solutions….

This process leads to a gradual deterioration of the material subject to oxidation and the loss of its characteristics (this can be easily seen in all those cases in which a metal surface rusts).

As shown in the photo below, the rust can't spread out even after 1800 hrs of salt spray chamber test.

The spray salt test complies with the requirements of ASTM B117

Corrosion after 1100 Hrs

Corrosion after 1450 Hrs

Corrosion after 1800 Hrs of salt spray chamber test.

Chapter 8: Coating Hardness Test (Wilborn Wolff method)

This instrument offers an easy to use method for the determination of film hardness for a coating applied to a flat substrate, by means of drawing pencil leads of known hardness at a constant applied mass across the coated surface.

Pencils of various grades of hardness are moved over the painted surface at an angle of 45° to the horizontal with a force of 5 N, 7.5 N or 10 N (± 0.1 N).
The pencil hardness is defined by those two grades of hardness the softer one of which just produces a writing trace while the next harder one leaves a perceptible scratch on the coating.
Then an optical evaluation is performed to verify the damage of the pencil hardness on the surface.

The Pencil Tester complies with the requirements of ISO 15184, ECCA-T4 /1.

Moving over the painted surface at an angle of 45°

Perceptible scratch on the coating

The test did not affect the paint

Chapter 9: Bending test at 90°

It is a method to evaluate the resistance of a coating film, or relative product, to crack or detach from the substrate is subjected to a deformation caused by bending performed by a cylindrical mandrel under standardized conditions. The plate painted with the product to be tested is folded with a standard cylindrical mandrel. The area being bent is then analyzed.

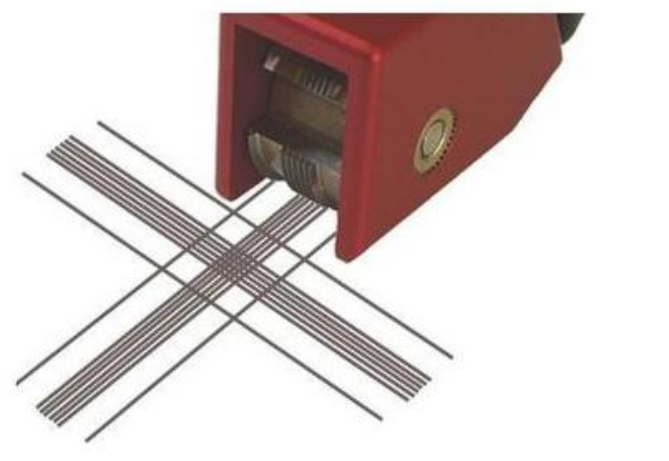
This test complies with the requirements of ISO 1519:2011

Longitudinal wire of a coated cage

Example of resistance to bending at 90°

Chapter 10: Grid test:

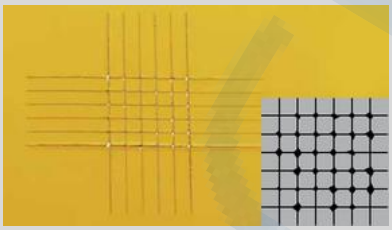
This method specifies a procedure to determine the adhesion of the paint to the support, of the paints to detachment from the supports when a pattern is created on the surface, up to the support. The test consists in making an incision on the coating with an appropriate cutter or metal blade, reaching the substrate. Create horizontal and vertical incisions to shape the reticle on the test surface. Apply adhesive tape to cover the incision area and remove vigorously. Visually observe the grid area to determine the result.



RESULTS OF THE TEST ON PATTERN
Adherence is classified according to the following scale:

ISO-o reference | ASTM-5B

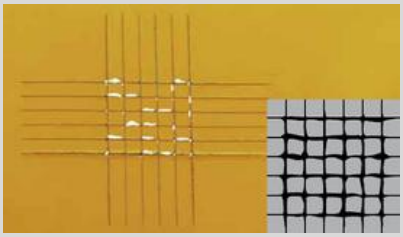
The edges of the cuts are completely flat; none of the small squares of the grid was detached.



ISO-1 reference | ASTM-5B

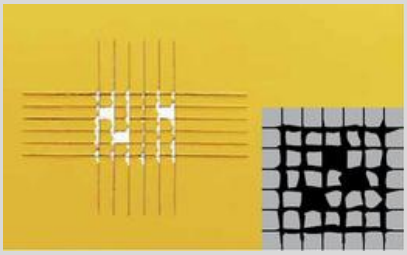
Suitable, after adequate preparation of the support, to receive a new painting. Detachment of small paint blades at the intersection of the cuts. The surface of the paint that has come off is approximately 5% of the grid area.
Suitable, after adequate preparation of the support, to receive a new painting.

Chapter 10: Grid test:



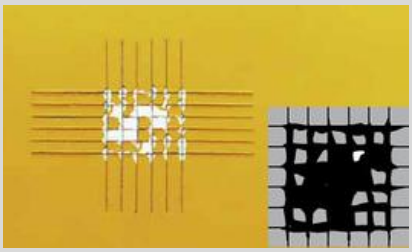
ISO-2 reference | ASTM-5B

The paint has come off at the intersection points and along the edges of the cuts. In this case, we have a painted surface that has fallen off between 5% and 15% of the total grid.



ISO-3 reference | ASTM-5B

The edges are almost completely detached and damaged and in some cases, even the small squares have become partially or completely detached. In this case, we have a painted surface that has fallen off between 15% and 35% of the total grid.



ISO-4 reference | ASTM-5B

The paint has come off in large strips along the edges of the cuts and/or have partially or completely detached some small squares. The surface of the paint that has come off varies between 35% and 65%.
Provide for partial or total scrapping of the surface before proceeding with a new painting.

ISO-5 reference | ASTM-5B

This reference value incorporates any degree of paint detachment that does not fall within the ISO-4 / ASTM-1B category values where we will notice a surface of detached paint greater than 65%.

Chapter 11: Safety Mesh

The Safety Mesh is a 100% LDPE extruded tubular net in polyethylene that combines, thanks to its production cycle, resistance and lightness, softness and elasticity. The particular rhomboid structure allows this mesh to be modelled around the areas of greatest impact of the cages of any shape, diameter or length. This ensures maximum protection of the most exposed areas during handling and transport.

Usage

The net has been developed to ensure greater protection, in the areas most exposed to wear or friction during handling, of the filter cages finished with the EcoHpc Plus cataphoresis treatment.

Availability

The Safety mesh is available in different diameters and lengths to easily adapt to our range of baskets, providing functional and economical protection.

Resistance

The Safety mesh in addition to protecting the surface of the cages during transport is resistant to the attack of bacteria, mold, rust, acids, solvents and chemical agents in general.

Safety

Thanks to the type of orange colouring, the mesh can be easily seen, guaranteeing greater visibility of the product during handling and storage, increasing prevention on-site safety

Disposal

The Safety mesh is 100% recyclable. The product must be disposed of or recycled in accordance with relevant national, regional or local laws regulations. Official document available upon request

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