

TECHNOLOGICAL CARD FOR COATING STEEL STRUCTURES
FOR SYSTEM PRODUCTS
FLAME STAL® FIREPROOF SOLVENT

WIŚLINA 2021-04-07
Supporting materials

Edition 1

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Source documents:

European Technical Approval	<u>ETA-20/0957</u>
Certificate of Conformity of Performance Properties	1396-CPR-0199
Hygienic Certificate	<u>B-BK-60211-0096/21</u>
National Declaration of Performance	FS-013-1-2023-06-02

1. Technical description of the product

The Flame Stal® Fireproof Solvent paint system is a set of three layers of paint coatings, which includes: an epoxy primer coating, a fire-retardant intumescent coating, and a polyurethane topcoat. The set is intended for three- or four-sided fire protection of steel and galvanized steel structure elements with open and closed profiles inside and outside buildings in order to obtain fire resistance class R15, R20, R30 R60. The system creates fireproof sets that are resistant to environmental influences X, Y, Z1, Z2 and corrosive aggressiveness (C1, C2, C3, C4, C5). Information on the selection of coatings for kits is included in the Tables below.

The System includes the following paint coatings:

- **primer coating** with a coating thickness of not less than 0.06 mm for structures used indoors, and for use in corrosive environments of C3 or higher:
- primer coating with a coating thickness of not less than 0.06 mm for structures used indoors, and for use in corrosive environments of C3 or higher:

Evaluated type of primer possible to use in the system	Permissible thickness range [µm]		
	minimum	average	maximum
two-component epoxy	60	90	120
two-component epoxy with high phosphate content	60	90	120
two-component zinc-rich epoxy (metallic zinc powder)	60	90	120
galvanized steel / two-part epoxy bond coat (bond layer thickness only)	60	90	150

or listed below by name Table2 - recommended by the manufacturer for use as a primer together with Flame Stal® Fireproof Solvent.

➤ **intumescent coating**

Flame Stal® Fireproof Solvent paint, the thickness of the coating depends on the required fire resistance class, the massiveness index of the protected cross-section, the cross-sectional stress factor (μ) or the critical temperature of the steel. The coating thicknesses are given in the relevant tables in European Technical Approval ETA-20/0957. Massivity $U/A[m^{-1}]$ is the ratio of the circumference of the heated element to the surface area of its cross-section. Coating thicknesses can be found in the specifications for fireproof profiles.

The assessed possible topcoats resistant to the external environment are presented in Table 3:

Table 3

Possible topcoats	Permissible thickness range [μm]		Environmental conditions met			
	minimum	maximum	Type Z ₂	Type Z ₁	Type Y	Type X
Carbothane 134 PU	80	120	✓	✓	✓	✓
Karbopur	80	120	✓	✓	✓	✓
Temathane 50	80	120	✓	✓	✓	✓
Purmal 90 MIX	80	120	✓	✓	✓	✓
Polyfinish MUDL	80	120	✓	✓	✓	✓
Remoplast UVC HS ES	80	120	✓	✓	✓	✓
Hempathane 55210	80	120	✓	✓	✓	✓
Teknodur 70 5-00	80	120	✓	✓	✓	✓
Dualcotex M.S. M30	80	120	✓	✓	✓	✓
Telpur T320	80	120	✓	✓	✓	✓
Two-component polyurethane enamel	80	120	✓	✓	✓	✓
PROTECT.SC PU/M 30-40	80	120	✓	✓	✓	✓
bez powłoki nawierzchniowej	-	-	✓			

- **topcoat:** The coating thickness of the surface layer should be selected depending on the impact of environmental factors and the environmental corrosivity category:
- the thickness of the polyurethane topcoat for the impact of environmental factors X (outdoor use) is at least 0.12 mm,
- the thickness of the polyurethane topcoat for environmental corrosivity categories C4, C5 is at least 0.12 mm,
- the thickness of the polyurethane topcoat for Y is at least 0.08 mm,
- the thickness of the polyurethane topcoat for Z1, Z2 or C3 (indoor use) is at least 0.06 mm,
- the thickness of the topcoat for decorative purposes for Z1, Z1 (indoor use) is at least 0.06 mm,
- when using matte and semi-matt topcoats, the minimum thickness of the topcoat is 0.12 mm.
- Without topcoat
- Polyurethane coatings for decorative purposes, allowable thicknesses from 0.05 to 0.1 mm

Note

- ✓ When using matte and semi-matt topcoats or non-process pigmented paints in dark or gray colors, the minimum thickness of the topcoat should be 0.12 mm, painted in two layers.

Evaluated sets of paint coatings that can be used - resistant to corrosive environments:

Table 4

Declared corrosion resistance with selected primers and topcoats					
Type of topcoat	Paint set	DFT	Corrosion protection		
		mm	C1-C3	C1-C4	C1-C5
Primer	Karbokor Miox	0,06	✓		
Reactive coating	Flame Stal® Fireproof Solvent	wg ETA			
Top coat	Karbopur	0,08			
Primer	Epoxykor Primer	0,06	✓		
Reactive coating	Flame Stal® Fireproof Solvent	wg ETA			
Top coat	Purmal 90 MIX	0,8			
Primer	Carboguard 60	0,06	✓	✓	
Reactive coating	Flame Stal® Fireproof Solvent	wg ETA			
Top coat	Carbothane 134 PU	0,12			
Primer	Carbomastic 15 LT	0,06	✓	✓	✓
Reactive coating	Flame Stal® Fireproof Solvent	wg ETA			
Top coat	Carbothane 134 PU	0,12			

2. Requirements for the steel surface before applying the priming layer

For primers from the epoxy family. Before painting, clean the surface using the abrasive blasting method to the purity level of Sa 2.5 or Sa 2 according to PN – ISO 8501-1:2008. Ry5 surface roughness within 40-60 µm, visual assessment. Cover the surface with primer paint no later than 6 hours after cleaning the element. Before cleaning, it is recommended to grind or round off sharp edges and remove welding spatter from the surface. The surface to be painted should be smooth, clean, dry, free of grease and other loose contaminants. Repaired surfaces - cleaned manually using workshop techniques, cleaned to classes ST2-ST3 can be primed with epoxy paints intended specifically for this purpose.

3. Requirements when applying the remaining coatings of the set

When carrying out any painting work, the following conditions must be strictly observed:

- when painting the coating, the ambient temperature should be consistent with the temperature required by the paint manufacturer,
- the substrate temperature should be at least 30 C above the air dew point,

- relative air humidity not higher than that provided by the manufacturer, for Carboline Polska paints the maximum humidity is 80%, Due to the nature of the protection performed, all work must be carried out with particular care, ensuring good ventilation and hardening conditions, e.g. protection against rainfall, condensing moisture or frost.
- When carrying out painting works, the required and applicable fire safety and occupational health and safety regulations must be strictly observed. Painting should be performed in accordance with the recommendations and guidelines contained in the paint manufacturer's technical data sheet.
- Sets with resistance C3, C4, C5 or X should be performed on warm, sunny days. During changeable weather, cold and rainy days, it is necessary to use covers against external influences, remember that the set has declared environmental resistance after it has completely hardened and is not completely resistant during its production.

4. Additional priming after application

Damage after installation of the primer paint applied before installation and assembly joints should be cleaned manually to a cleanliness level of at least St 2 according to PN-ISO 8501-1. Complete the coating with primer paint, following all the recommendations given above. Clean the surface of the entire structure from dirt and loose contaminants added during transport and assembly of the elements. Be sure to remove all traces of grease. Pay attention to the required recoating times.

5. Painting with Flame Stal® Fireproof Solvent

In the case of painting after assembly or when the structure is subject to periodic breaks in painting, clean the surface of the structure from dust and loose dirt introduced during the transport and assembly of the elements. Be sure to remove all traces of grease. The dry film thickness of the intumescent layer should be checked wet during painting.

6. Paint application techniques

Flame Stal® Fireproof Solvent paint is a thixotropic mixture with high wet layer stability. The paint is best applied by airless spray. It can also be applied with a brush or roller. The number of times the product is applied depends on the required thickness of the protection specified in the painting specification tables.

Airless spray parameters:

- | | |
|--|--------------------------|
| ✓ pressure ratios | min. 38 : 1 optimal 60:1 |
| ✓ nozzle diameter | from 0,017 to 0,023 |
| ✓ spray angle depends on the type of structure being painted | from 20 to 50 |
| ✓ 3/8" spray pipe, gun pipe tip approximately 2 m 1/4". | |

It is recommended to remove filters from the sprayer and gun.

The drying time between one application and the next when applying with a brush is approximately 2 hours. Application times for applying paint using airless spray with hydrodynamic pumps using professional equipment were determined for a relative humidity of 65% with good hall ventilation and are given in the tables below. In the case of lower temperatures, the times increase proportionally, i.e. for a temperature of 100 C, the times should be doubled. Painting and drying temperatures above 30°C may affect the surface quality, dry spraying or cracking of the coating.

Table of minimum times to repaint the next layer of Flame Stal®.

Layer thickness(mm) Flame Stal®	ambient temperature	Time to repaint	ambient temperature	Time to repaint
0,5	10 C	6 h	20 C	3 h
1	10 C	16 h	20 C	8 h

Tabela czasów do malowania farbami nawierzchniowymi

Grubość warstwy (mm) Flame Stal®	ambient temperature	Time to repaint	ambient temperature	Time to repaint
0,5	10 C	16 h	20 C	12 h
1	10 C	48 h	20 C	36 h

Note: Flame Stal® Fireproof Solvent is a quick-drying paint that contains fillers that allow very thick wet layers to be applied. Wet painting above a thickness of 1 mm is not recommended, as in some cases it may cause coating defects. When hydrodynamically applying thin layers (e.g. for minimum thicknesses), they should be applied once!

It is recommended to apply topcoats immediately after the Flame Stal® paint has hardened and measurements have been taken, i.e. within 12 to 48 hours of completing the work, depending on the thickness of the intumescent layer and the ambient temperature.

The paint immediately after painting is sensitive to standing water, rainfall and condensation, so it cannot be exposed to this type of action. On warm, windy days, short showers are not harmful. Rain covers should be provided for painting during rainy months

7. Mixing paints

Flame Stal® Fireproof Solvent is thixotropic and intensive mixing facilitates its application and prevents it from running off. Remember to mix the paint very thoroughly. Mix for at least 3-5 minutes with a mechanical mixer at approx. 500 rpm, pay attention to the formation of air bubbles - if they occur during mixing, leave the paint aside for approx. 60 minutes to release them into the atmosphere (in the case of hand painting).

Preparation of primers and topcoats: Always follow the manufacturer's technical information - see the technical data sheet for the selected paint.

NOTE: The paint in the cans is ready to use and only requires mixing.

To dilute the Flame Stal® Fireproof Solvent paint or to clean and maintain equipment, use a thinner - Piroixonol PT. Use dilution only when necessary for airless painting and for manual painting with a brush or roller. Maximum diluent addition 3-5% by volume.

8. Drying time (at 200 C)

step 1	0,25h
step 3	2 h

The recommended time interval between applying individual layers of Flame Stal® paint, depending on the application technique for the hydrodynamic technique, is from 3 to 16 hours. See point 6.

Color	white,	possible pastel shade
VOC	[%]	81 % + - 3 %
Density	[g/cm ³]	1,42 +- 5%
Flashpoint	[⁰ C]	25
LZO (VOC)	[g/dm ³]	23,47 ± 1,88

9. Painting the topcoat

Depending on the required degree of corrosion resistance or environmental load of the facility, the following painting systems are used:

Without topcoat for the Z1 system

environmental load / corrosion resistance class: Z2 / C1, C2 - inside the facility, use polyurethane or acrylic paint as a topcoat, the minimum dry paint coating thickness should be 80 µm.

environmental load / corrosion resistance class: Y/C3, use a dry polyurethane topcoat with a minimum thickness of 80 µm as a topcoat.

environmental load / corrosion resistance class: X /C4, C5 - outside the facility, use a dry polyurethane topcoat with a minimum thickness of 120 µm.

Paint layers of topcoat paint after the intumescent paint coating has fully hardened and after measuring its thickness.

The complete hardening time of the set including the topcoat is 4 days, depending on the thickness of the topcoat.

10. Coating repairs

11. - during painting, before painting with topcoat, or during assembly, they do not require prior arrangements with the Manufacturer

12. - repair of coatings damaged during operation requires the preparation of IDT in the form of repair technology.

Quality control should include checking:

- adhesion of the intumescent coating to the anti-corrosion coating - if the requirement is indicated in the technical specification for fire protection.
- the thickness of individual layers of protection in the wet state, conducting continuous control during the application of coatings.
- thickness of individual protection coatings in a dry state.
- When performing painting work, environmental conditions should be recorded and a daily work log should be kept. Sample forms necessary for proper documentation of painting work and delivery documentation are included in the appendix, pages 9 to 20..

12. Information about the fire protection performed should be placed on the facility or entered in the construction log.

The content of this information should include at least:

- ✓ name of the set according to this ETA,
- ✓ fire resistance class of the set,
- ✓ name of the company making the fire protection kit,
- ✓ date of completion of the fire protection kit,
- ✓ acceptance report of the fire protection set.

13. Occupational Health and Safety Conditions of Storage and Transport

Transport ADR/RID/ADN/ADNR UN 1263 class II, III. Contains flammable, explosive solvents. Fumes harmful to health. Avoid direct contact with skin. Be careful until the coating is completely dry. Keep away from heat, flame and sparks. Application and drying should take place in a well-ventilated room. Use personal protective equipment when applying. Close the container tightly after each use. Being in solvent vapors without



proper protection or ventilation is harmful to health. Before opening the container, read the safety instructions on the packaging. The product should be applied by well-trained personnel.
Store at a positive temperature in well-ventilated rooms with explosion-proof electrical installations.

14. Handling of waste and used packaging

The paint user undertakes to: Separating storage space for paints: separately for empty and full packages. Marking of rooms in accordance with applicable regulations. Before disposal, all used empty paint cans should be carefully cleaned of any paint residues. It is forbidden to leave paint beakers, garbage or other waste in cans and throw them into public garbage cans. In the event of a spill or other type of waste, follow the paint's SDS

15. Precautions: paint intended for industrial use for trained workers working with personal protective equipment, ventilation and technical protection

On contact with skin:	Wash thoroughly with soap and water
On contact with eyes	Keeping your eyelids closed, rinse under running water for at least 15 minutes; seek advice from a specialist
If swallowed	Rinse mouth immediately, do not induce vomiting, seek immediate medical attention.
Storage and handling	Store in a dry and cool place (below 35°C) away from children. Avoid contact with food. During operation, do not eat, drink or smoke. Do not dispose of the product into drains or water courses. Ensure disposal complies with local or state regulations.
Environmental Protection	

The instructions for use do not constitute a warranty for the product or the fire protection system. It only provides information necessary for the user when developing specifications for painting a given object and carrying out painting works. It was developed in accordance with our current knowledge and experience. The instructions may be changed without prior notice. Each subsequent release cancels the content of the previous one. Therefore, when using the information provided, please make sure that the User's Manual is still up to date.

If you have any questions or concerns, please contact our technical consultant.

Manufacturer **PIROSYSTEM SP. Z O.O. POLSKA**
www.pirosystem.pl



SUPPORTING MATERIALS
Number of reference surfaces

The size of the structure (surface subject to painting) m²	Recommended maximum number of reference surfaces	Recommended maximum percentage of the reference area in relation to the total area of the structure	Recommended maximum total area of reference surfaces m²
up to 2 000	3	0,6	12
over 2000 to 5000	5	0,5	25
over 5000 to 10000	7	0,5	50
over 10000 to 25000	7	0,3	75
over 25000 to 50000	9	0,2	100
over 50000	9	0,2	200

Recommended form for the reference plot protocol

Protocol on reference surfaces for anti-corrosion work		
Investor:		
Person preparing the documentation:		
Design:		
Component:		
	Company	Responsible person
Surface preparation:		
Painting works:		
Supplier of paint products:		
Reference surface1)		Size, in m2
Location and marking:		
Initial surface condition:		
Hot-dip galvanized surfaces		
Zinc corrosion (e.g. white rust): YES NO		
Aging degree (rating):		
Additional information:		
Painted surface		
Type(s) of coating (including thickness and age, if known): Rust		
degree according to ISO 4628-3:		
Degree of disease according to ISO 4628-2:		
Degree of cracking according to ISO 4628-4:		
Degree of exfoliation according to ISO 4628-5:		
Additional information:		
Surface preparation:		
Degree of preparation (ISO 8501-1 / ISO 8501-2):		
Other information regarding the surface preparation method and the grade obtained2):		

Notes:			
	1	2	3
	Primer coating	Interlayer	Topcoat
Lacquer product			
-Manufacturer			
-Trade name			
-Batch and/or production number			
Color			
Application method			
Air temperature, *C			
Dew point, °C			
Weather conditions (brief description)			
Paint product thinner (type and quantity), if added			
Other measurements, e.g. grip			
Average coating thickness, µm3)			
- wet (device used)			
- dry (device used)			
Average total thickness, µm3)			
Date			
Time			
Location of painting works			



company name			
Signatures of responsible persons			
<p>1) Each reference surface must have a separate sheet, 2) For example, in the case of preparation grades St2 and St3, whether hand tools or mechanical tools were used 3) Individual measurements on a separate sheet</p>			

PAINT COATING CONDITION ASSESSMENT FORM.

Properties	Location of the test/assessment	Test result	Photo-no.	Percentage of damage in relation to the entire surface
1	2	3	4	5
1. Assessment of damage to paint coatings:				
Blistering wg PN-EN ISO 4628-2: 2005P	Damage: <input type="checkbox"/> topcoat <input type="checkbox"/> the entire system Damage Size: <input type="checkbox"/> whole surface <input type="checkbox"/> locally			
Corrosion wg PN-EN ISO 4628-3 : 2005P	Damage: <input type="checkbox"/> topcoat <input type="checkbox"/> the entire system Damage Size: <input type="checkbox"/> whole surface <input type="checkbox"/> locally			
Cracks wg PN-EN ISO 4628-4 : 2005P	Damage: <input type="checkbox"/> topcoat <input type="checkbox"/> the entire system Damage Size: <input type="checkbox"/> whole surface <input type="checkbox"/> locally			
Exfoliation wg PN-EN ISO 4628-5 : 2005P	Damage: <input type="checkbox"/> topcoat <input type="checkbox"/> the entire system Damage Size: <input type="checkbox"/> whole surface <input type="checkbox"/> locally			
Chalking wg PN-EN ISO 4628-6 : 2012P	Damage: <input type="checkbox"/> topcoat <input type="checkbox"/> the entire system Damage Size: <input type="checkbox"/> whole surface <input type="checkbox"/> locally			
Other defects	Damage: <input type="checkbox"/> topcoat <input type="checkbox"/> the entire system Damage Size: <input type="checkbox"/> whole surface <input type="checkbox"/> locally			



ANNEX (continued)

1	2	3	4	Uwagi
2. Adhesion of coatings				
Adhesion wg PN-EN ISO 2409:2013-06E	<input type="checkbox"/> interlayer <input type="checkbox"/> to the ground			
Adhesion wg PN-EN ISO 4624:2004P	<input type="checkbox"/> coating system			
Adhesion Wg PN-EN ISO 16276-2:2008	<input type="checkbox"/> interlayer <input type="checkbox"/> to the ground			
3. Thickness of coatings				
According to PN- EN ISO 2808:2008P				
Instruments for measuring thickness and adhesion				

Signature of the Person Performing the Assessment

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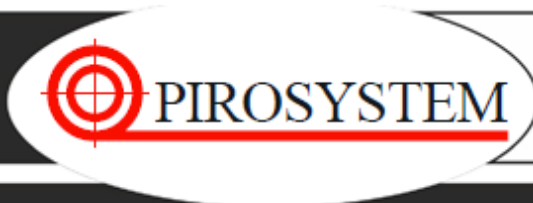


ZINC COATING CONDITION ASSESSMENT FORM

Properties	Location of the test/assessment	Test result	Photo no.	Notes
1	2	3	4	
1. Ocena zniszczeń powłoki cynku zgodnie PN-EN ISO 10289:2002:				
R_p index				
index R_A				
Visual assessment				
2. Thickness of the zinc coating				
In accordance with PN-EN ISO 2808:2008				

Signature of the Person Performing the Assessment

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PAINT QUALITY CONTROL FORM

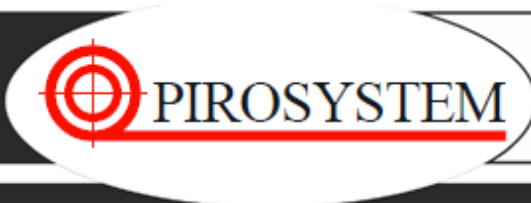
Place of inspection:		
1.	Manufacturer	
2.	Name	
3.	Batch no.	
4.	Quality control certificate no.	
5.	Packaging condition	<input type="checkbox"/> damaged <input type="checkbox"/> undamaged
6.	Sediment	<input type="checkbox"/> easy to mix <input type="checkbox"/> difficult to mix <input type="checkbox"/> impossible to mix
7.	Presence of skin	
8.	Inclusions	
9.	Phase separation	
10.	Consistency (e.g. gelling)	
11.	Color	
12.	Notes	

Signature of the Person Performing the Assessment

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Recommended form for documentation and acceptance of anti-corrosion works

Construction:	Project no:					
	Protective painting system:					
	1 coat	2 coat	3 coat	4 coat	5 coat	
Painting contractor						
Description of the condition of the surface being treated						
<p>Surface preparation treatment:</p> <p>Cleaning with hand and mechanical tools St2 St 3 PSt 2 PSt 3</p> <p>Mechanical grinding PMa</p> <p>Washing and degreasing</p> <p>Means:</p> <p>Preparations:</p> <p>Tools:</p>						
	Surface preparation details	Szczegóły dotyczące nakładania farby				
		1 coat	2 coat	3 coat	4 coat	5 coat
Obtained degree of surface preparation (PN-ISO 8501-1, PN-ISO 8501-2)						
Obtained surface cleanliness: Degreasing Degree of dust removal Ionic purity Other comments						



Date						
Air temperature, °C						
Relative air humidity, %						
Dew point, °C						
surface temperature, °C						
Weather conditions (brief description)						
Determining the paint and type of coating,						
Color						
Batch no.						
Paint manufacturer						
Paint condition						
Dilution						
Thinner						
Application method						
Wet thickness						
Drying times: To apply the next layer Total						
Coating appearance (concise description)						
NDFT μm						
DFT min. μm						
DFT average μm						
DFT max. μm						
Is according to the documentation			Yes/no	Yes/no	Yes/no	Yes/no
Reference surfaces: Date of execution						



Protocol		
Location		
Notes		
	First name and last name	Signature/date
Contractor		
Inspector		