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Series: TECHNICAL APPROVALS

## **TECHNICAL APPROVAL ITB AT-15-7324/2007**

On the basis of the decree of the Minister of Infrastructure of 8 November 2004 on technical approvals and organisational entities authorised to issue them (Journal of Laws No. 249/2004, item 2497), following the procedure of approval carried out at the Building Research Institute on request of the company:

**A+B POLSKA Sp. z o.o.**  
**80-298 Gdańsk, ul. Kadetów 5/13**

it is hereby certified that the products named below are suitable for application in the building industry:

### **Set of painting products of the Flame Stal system for fire-protecting of steel and galvanised steel structures**

with the scope and the rules as set out in the Annexe constituting an integral part of this Technical Approval ITB.

Expiration date:  
20 June 2012



DIRECTOR  
Building Research Institute

*doc. dr inż. Stanisław M. Wierzbicki*

Annexe:  
General and technical provisions

Warsaw, 20 June 2007

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## **GENERAL AND TECHNICAL PROVISIONS**

### **1. SUBJECT MATTER OF THE APPROVAL**

The subject matter of this Technical Approval ITB is the set of products for fire-protecting of steel and galvanised steel structures with the Flame Stal system. The set of products consists of:

- 1) two-component anticorrosive epoxy paint named Carboguard 888, used for executing the prime layer of the protection,
- 2) fire-protecting paint named Flame Stal<sup>®</sup>, used for executing the principal layer of the protection, swelling in fire conditions,
- 3) two-component polyurethane paint named Carbothane 134 PU, used for executing the top layer of the protection.

The paints Carboguard 888 and Carbothane 134 PU are manufactured by the American company Carboline, represented in Poland by the company Carboline Polska Sp. z o.o., 03-879 Warszawa, ul. Przeclawska 5.

The manufacturer of the fire-protecting paint Flame Stal<sup>®</sup>, and the collator of the set of products for executing fire protections of the Flame Stal system, is the company A+B Polska Sp. z o.o., 80-298 Gdańsk, ul. Kadetów 5/13.

The required technical properties of the paints Carboguard 888, Carbothane 134 PU and Flame Stal<sup>®</sup>, as well as of fire protections executed using the Flame Stal system, are specified in point 3.

### **2. PURPOSE, SCOPE AND CONDITIONS OF APPLICATION**

#### **2.1. Purpose and Scope of Application**

The set of products of the Flame Stal system is designated for three- and four-sided fire-protecting of elements of open and closed sections, of steel and galvanised steel with the zinc layer of thickness not greater than 0.15 mm, from the thermal impact of standard fires (according to PN-EN 1363-1:2001). Fire-protected elements may be applied inside and outside of buildings in environments of corrosiveness category C1, C2, C3, C4, C5-I and C5-M (according to PN-EN ISO 12944-2:2001), after fulfilling the conditions specified in point 2.2.2.

Steel or galvanised steel elements protected in accordance with the requirements specified in this Approval have been classified to the fire resistance classes: R 15, R 30, R 45 and R 60 according to the standard PN-EN 13501-2:2005.

## **2.2. Conditions of Application**

**2.2.1. General provisions.** The fire protections of the Flame Stal system should be executed in accordance with the technical documentation of the protection, elaborated for a specific object, taking into account the requirements of construction regulations and this Technical Approval ITB.

The fire protections should be executed by companies which are licensed and trained by the Applicant of the Approval in the scope of conditions and technologies of execution of the protections, technical properties of painting products and inspection of executed works.

Information about an executed protection should be entered in the construction log. The content of this information should include, at least:

- name of the fire protection according to this Technical Approval ITB,
- fire resistance class of the protected elements,
- name of the company executing the fire protection,
- date of execution of the fire protection,
- acceptance protocol of execution of the fire protection.

**2.2.2. Conditions of execution of fire protections.** The following conditions should be satisfied while executing fire protections of the Flame Stal system:

1. The surfaces being protected should be prepared in accordance with the conditions of application of paints, specified in manufacturer data sheets, and they should satisfy the requirements specified in the standard PN-EN ISO 12944-4:2001.
2. The two-component anticorrosive epoxy paint Carboguard 888 should be used for executing the prime layer of the protection. In the case of galvanised steel substrate, the swelling paint may be applied directly on the substrate, omitting the prime layer of the protection, unless the zinc coat exhibits damage, e.g. no adhesion, scaling. The prime layer of the protection may be executed of other epoxy paints hardened with polyamides, aliphatic polyamines, amines or polyamino-amides, indicated by the Applicant of the Approval. The anticorrosive paint should be prepared for application and applied on the substrate in accordance with its conditions of use specified by the manufacturer in product data sheets. Thickness of the prime layer (after drying) should be at least 60 µm, it may only be lower in the case of environments of corrosiveness category C1 and C2 (inside buildings) but not lower than 40 µm.

3. The paint Flame Stal<sup>®</sup> should be used for executing the principal (swelling) layer of the protection. This paint may be applied by spraying, with brush or with roller on substrate which has been protected against corrosion (as in item 2), dried and dedusted. Thickness of the principal layer depends on the required fire resistance class of the steel structure, the protected element cross-section massiveness indicator, and the critical temperature of steel, and it should be in accordance with the required thicknesses specified in point 2.2.3.

The principal layer should be executed at ambient temperature not lower than +5°C and not higher than 45°C, at relative humidity of air not higher than 80%, on bright days (without rain or fog). It should be observed that the temperature of the surface being painted be higher by at least 3°C than the dew-point.

4. The two-component polyurethane paint Carbothane 134 PU should be used for executing the top layer of the protection. The top layer of the protection may be executed of other polyurethane paints and enamels hardened with isocyanates, indicated by the Applicant of the Approval. In the case of environments of corrosiveness category C1, C2, C3 and C4, the top layer of the protection may also be executed of the acrylic paint Carboline TS 615 (manufactured by the Carboline company). The top-coat paint should be prepared for application and applied on the substrate in accordance with its conditions of use, specified by the manufacturer in the product data sheets. Thickness of the top layer of polyurethane paints and enamels and acrylic paints depends on the corrosiveness category of the environment and it should be at least:
  - 60 µm – in the case of environment of corrosiveness category C1, C2 and C3,
  - 80 µm – in the case of environment of corrosiveness category C4,
  - 120 µm – in the case of environment of corrosiveness category C5-I and C5-M.

In the case of environments of corrosiveness category C1 and C2 (inside buildings), the fire protection of the Flame Stal system may be executed without the top layer.

The conditions of safe use of painting products, specified by the manufacturer in the product data sheets, elaborated in accordance with the decree of the Minister of Health of 3 July 2002 on hazardous substance and hazardous preparation data sheet (Journal of Laws No. 140, item 1171), should be observed during execution of fire protections.



Table 1, continued

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
141÷160	0.48	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
161÷180	0.53	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
181÷200	0.56	0.33	0.30	0.30	0.30	0.30	0.30	0.30	0.30
201÷220	0.59	0.36	0.30	0.30	0.30	0.30	0.30	0.30	0.30
221÷240	0.61	0.38	0.30	0.30	0.30	0.30	0.30	0.30	0.30
241÷260	0.63	0.40	0.30	0.30	0.30	0.30	0.30	0.30	0.30
261÷280	0.64	0.41	0.30	0.30	0.30	0.30	0.30	0.30	0.30
281÷300	0.65	0.42	0.30	0.30	0.30	0.30	0.30	0.30	0.30
301÷320	0.76	0.49	0.31	0.30	0.30	0.30	0.30	0.30	0.30
321÷340	0.77	0.51	0.32	0.30	0.30	0.30	0.30	0.30	0.30
341÷360	0.78	0.52	0.33	0.30	0.30	0.30	0.30	0.30	0.30
361÷380	0.79	0.52	0.33	0.30	0.30	0.30	0.30	0.30	0.30
381÷400	0.80	0.53	0.34	0.30	0.30	0.30	0.30	0.30	0.30

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

Table 2

Minimum thickness of fire protections of the Flame Stal system – open sections.

Fire resistance class R 30

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	1.20	0.65	0.38	0.30	0.30	0.30	0.30	0.30	0.30
81÷100	1.29	0.79	0.51	0.33	0.30	0.30	0.30	0.30	0.30
101÷120	1.34	0.87	0.59	0.41	0.30	0.30	0.30	0.30	0.30
121÷140	1.37	0.92	0.64	0.46	0.33	0.30	0.30	0.30	0.30
141÷160	1.40	0.95	0.68	0.50	0.37	0.30	0.30	0.30	0.30
161÷180	1.41	0.98	0.71	0.52	0.39	0.30	0.30	0.30	0.30
181÷200	1.42	0.99	0.73	0.55	0.41	0.31	0.30	0.30	0.30
201÷220	1.43	1.01	0.75	0.56	0.43	0.33	0.30	0.30	0.30
221÷240	1.44	1.02	0.76	0.58	0.44	0.34	0.30	0.30	0.30
241÷260	1.44	1.03	0.77	0.59	0.46	0.35	0.30	0.30	0.30

Table 2, continued

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
261÷280	1.45	1.04	0.78	0.60	0.46	0.36	0.30	0.30	0.30
281÷300	1.45	1.05	0.79	0.61	0.47	0.37	0.30	0.30	0.30
301÷320	—	1.36	1.04	0.81	0.63	0.49	0.37	0.30	0.30
321÷340	—	1.37	1.06	0.82	0.64	0.50	0.38	0.30	0.30
341÷360	—	1.38	1.07	0.83	0.65	0.51	0.39	0.30	0.30
361÷380	—	1.39	1.08	0.84	0.66	0.51	0.39	0.30	0.30
381÷400	—	1.40	1.09	0.85	0.67	0.52	0.40	0.30	0.30

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

Table 3

Minimum thickness of fire protections of the Flame Stal system – open sections.

Fire resistance class R 45

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	—	—	1.04	0.74	0.54	0.40	0.30	0.30	0.30
81÷100	—	—	1.13	0.84	0.64	0.49	0.38	0.30	0.30
101÷120	—	—	1.18	0.90	0.70	0.55	0.44	0.34	0.30
121÷140	—	—	1.21	0.93	0.74	0.59	0.47	0.38	0.31
141÷160	—	—	1.23	0.96	0.76	0.62	0.50	0.41	0.33
161÷180	—	—	1.25	0.98	0.79	0.64	0.52	0.43	0.35
181÷200	—	—	1.27	1.00	0.80	0.66	0.54	0.45	0.37
201÷220	—	—	1.28	1.01	0.82	0.67	0.55	0.46	0.38
221÷240	—	—	1.29	1.02	0.83	0.68	0.57	0.47	0.39
241÷260	—	—	1.29	1.03	0.84	0.69	0.57	0.48	0.40
261÷280	—	—	1.30	1.04	0.85	0.70	0.58	0.49	0.41
281÷300	—	—	1.30	1.04	0.85	0.71	0.59	0.50	0.42
301÷320	—	—	—	1.45	1.20	1.00	0.83	0.70	0.58
321÷340	—	—	—	1.47	1.21	1.01	0.84	0.71	0.59
341÷360	—	—	—	—	1.23	1.02	0.86	0.72	0.60

Table 3, continued

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
361÷380	—	—	—	—	1.24	1.03	0.87	0.73	0.61
381÷400	—	—	—	—	1.25	1.05	0.88	0.74	0.62

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

Table 4

Minimum thickness of fire protections of the Flame Stal system – open sections.

Fire resistance class R 60

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	—	—	1.42	1.28	0.99	0.78	0.63	0.51	0.41
81÷100	—	—	1.44	1.34	1.06	0.86	0.70	0.58	0.48
101÷120	—	—	—	1.38	1.11	0.91	0.75	0.63	0.53
121÷140	—	—	—	1.41	1.14	0.94	0.79	0.66	0.56
141÷160	—	—	—	1.42	1.16	0.97	0.81	0.69	0.59
161÷180	—	—	—	1.43	1.18	0.99	0.83	0.71	0.61
181÷200	—	—	—	1.44	1.19	1.00	0.85	0.72	0.62
201÷220	—	—	—	1.45	1.21	1.01	0.86	0.74	0.63
221÷240	—	—	—	1.46	1.21	1.02	0.87	0.75	0.64
241÷260	—	—	—	1.47	1.22	1.03	0.88	0.75	0.65
261÷280	—	—	—	1.48	1.23	1.04	0.88	0.76	0.66
281÷300	—	—	—	—	1.24	1.05	0.89	0.77	0.67
301÷320	—	—	—	—	—	1.46	1.29	1.12	0.97
321÷340	—	—	—	—	—	1.47	1.31	1.13	0.98
341÷360	—	—	—	—	—	—	1.33	1.15	1.00
361÷380	—	—	—	—	—	—	1.34	1.16	1.01
381÷400	—	—	—	—	—	—	1.35	1.17	1.02

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

**Table 5**

Minimum thickness of fire protections of the Flame Stal system – rectangular tubes.

Fire resistance class R 15

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
81÷100	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
101÷120	0.43	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
121÷140	0.53	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
141÷160	0.60	0.34	0.30	0.30	0.30	0.30	0.30	0.30	0.30
161÷180	0.65	0.39	0.30	0.30	0.30	0.30	0.30	0.30	0.30
181÷200	0.69	0.43	0.30	0.30	0.30	0.30	0.30	0.30	0.30
201÷220	0.73	0.47	0.30	0.30	0.30	0.30	0.30	0.30	0.30
221÷240	0.75	0.49	0.30	0.30	0.30	0.30	0.30	0.30	0.30
241÷260	0.78	0.52	0.33	0.30	0.30	0.30	0.30	0.30	0.30
261÷280	0.79	0.54	0.34	0.30	0.30	0.30	0.30	0.30	0.30
281÷300	0.81	0.55	0.36	0.30	0.30	0.30	0.30	0.30	0.30
301÷320	0.86	0.59	0.38	0.30	0.30	0.30	0.30	0.30	0.30
321÷340	0.88	0.61	0.39	0.30	0.30	0.30	0.30	0.30	0.30
341÷360	0.89	0.62	0.41	0.30	0.30	0.30	0.30	0.30	0.30
361÷380	0.90	0.64	0.42	0.30	0.30	0.30	0.30	0.30	0.30
381÷400	0.91	0.65	0.43	0.30	0.30	0.30	0.30	0.30	0.30

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

**Table 6**

Minimum thickness of fire protections of the Flame Stal system – rectangular tubes.

Fire resistance class R 30

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	1.14	0.67	0.39	0.30	0.30	0.30	0.30	0.30	0.30
81÷100	1.32	0.85	0.56	0.36	0.30	0.30	0.30	0.30	0.30

Table 6, continued

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
101÷120	1.42	0.97	0.68	0.47	0.31	0.30	0.30	0.30	0.30
121÷140	—	1.05	0.75	0.54	0.38	0.30	0.30	0.30	0.30
141÷160	—	1.11	0.81	0.60	0.43	0.30	0.30	0.30	0.30
161÷180	—	1.15	0.86	0.64	0.47	0.34	0.30	0.30	0.30
181÷200	—	1.19	0.90	0.68	0.50	0.37	0.30	0.30	0.30
201÷220	—	1.22	0.93	0.71	0.53	0.39	0.30	0.30	0.30
221÷240	—	1.24	0.95	0.73	0.56	0.41	0.30	0.30	0.30
241÷260	—	1.26	0.97	0.75	0.58	0.43	0.32	0.30	0.30
261÷280	—	1.28	0.99	0.77	0.59	0.45	0.33	0.30	0.30
281÷300	—	1.29	1.01	0.78	0.61	0.46	0.34	0.30	0.30
301÷320	—	—	1.22	0.96	0.75	0.58	0.42	0.30	0.30
321÷340	—	—	1.24	0.98	0.77	0.59	0.44	0.31	0.30
341÷360	—	—	1.26	1.00	0.79	0.61	0.45	0.32	0.30
361÷380	—	—	1.27	1.02	0.81	0.62	0.47	0.33	0.30
381÷400	—	—	1.29	1.03	0.82	0.64	0.48	0.34	0.30

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

Table 7

Minimum thickness of fire protections of the Flame Stal system – rectangular tubes.

Fire resistance class R 45

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	—	—	1.10	0.79	0.58	0.43	0.32	0.30	0.30
81÷100	—	—	1.20	0.90	0.69	0.53	0.41	0.31	0.30
101÷120	—	—	1.27	0.97	0.76	0.60	0.47	0.37	0.30
121÷140	—	—	1.31	1.02	0.81	0.64	0.51	0.41	0.32
141÷160	—	—	1.35	1.06	0.84	0.68	0.54	0.44	0.35
161÷180	—	—	1.37	1.08	0.87	0.70	0.57	0.46	0.37
181÷200	—	—	1.39	1.11	0.89	0.72	0.59	0.48	0.39
201÷220	—	—	1.41	1.12	0.91	0.74	0.61	0.50	0.40

Table 7, continued

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
221÷240	—	—	1.42	1.14	0.92	0.76	0.62	0.51	0.42
241÷260	—	—	1.43	1.15	0.94	0.77	0.63	0.52	0.43
261÷280	—	—	1.44	1.16	0.95	0.78	0.64	0.53	0.44
281÷300	—	—	1.45	1.17	0.96	0.79	0.65	0.54	0.45
301÷320	—	—	—	—	1.31	1.09	0.91	0.76	0.62
321÷340	—	—	—	—	1.33	1.11	0.93	0.77	0.64
341÷360	—	—	—	—	1.35	1.13	0.94	0.78	0.65
361÷380	—	—	—	—	1.36	1.14	0.95	0.80	0.66
381÷400	—	—	—	—	1.38	1.16	0.97	0.81	0.67
* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer									

Table 8

Minimum thickness of fire protections of the Flame Stal system – rectangular tubes.

Fire resistance class R 60

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	—	—	—	1.29	1.01	0.80	0.65	0.52	0.43
81÷100	—	—	—	1.38	1.10	0.89	0.73	0.61	0.50
101÷120	—	—	—	1.44	1.16	0.95	0.79	0.66	0.55
121÷140	—	—	—	1.48	1.20	0.99	0.83	0.70	0.59
141÷160	—	—	—	—	1.23	1.02	0.86	0.73	0.62
161÷180	—	—	—	—	1.26	1.05	0.88	0.75	0.64
181÷200	—	—	—	—	1.28	1.07	0.90	0.77	0.66
201÷220	—	—	—	—	1.29	1.08	0.92	0.78	0.67
221÷240	—	—	—	—	1.30	1.10	0.93	0.80	0.68
241÷260	—	—	—	—	1.31	1.11	0.94	0.81	0.69
261÷280	—	—	—	—	1.32	1.12	0.95	0.82	0.70
281÷300	—	—	—	—	1.33	1.12	0.96	0.82	0.71
301÷320	—	—	—	—	—	—	1.36	1.17	1.02
321÷340	—	—	—	—	—	—	1.38	1.19	1.03

Table 8, continued

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
341÷360	—	—	—	—	—	—	1.40	1.21	1.05
361÷380	—	—	—	—	—	—	1.42	1.23	1.07
381÷400	—	—	—	—	—	—	1.43	1.24	1.08

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

Table 9

Minimum thickness of fire protections of the Flame Stal system – round tubes.

Fire resistance class R 15

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
81÷100	0.47	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
101÷120	0.62	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
121÷140	0.72	0.40	0.30	0.30	0.30	0.30	0.30	0.30	0.30
141÷160	0.79	0.48	0.30	0.30	0.30	0.30	0.30	0.30	0.30
161÷180	0.84	0.53	0.30	0.30	0.30	0.30	0.30	0.30	0.30
181÷200	0.89	0.58	0.33	0.30	0.30	0.30	0.30	0.30	0.30
201÷220	0.92	0.61	0.37	0.30	0.30	0.30	0.30	0.30	0.30
221÷240	0.95	0.64	0.40	0.30	0.30	0.30	0.30	0.30	0.30
241÷260	0.97	0.67	0.42	0.30	0.30	0.30	0.30	0.30	0.30
261÷280	0.99	0.69	0.44	0.30	0.30	0.30	0.30	0.30	0.30
281÷300	1.01	0.71	0.46	0.30	0.30	0.30	0.30	0.30	0.30
301÷320	1.06	0.76	0.49	0.30	0.30	0.30	0.30	0.30	0.30
321÷340	1.08	0.78	0.51	0.30	0.30	0.30	0.30	0.30	0.30
341÷360	1.09	0.79	0.53	0.30	0.30	0.30	0.30	0.30	0.30
361÷380	1.11	0.81	0.54	0.31	0.30	0.30	0.30	0.30	0.30
381÷400	1.12	0.82	0.56	0.32	0.30	0.30	0.30	0.30	0.30

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

**Table 10**

Minimum thickness of fire protections of the Flame Stal system – round tubes.

Fire resistance class R 30

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	1.41	0.93	0.56	0.30	0.30	0.30	0.30	0.30	0.30
81÷100	—	1.13	0.77	0.49	0.30	0.30	0.30	0.30	0.30
101÷120	—	1.26	0.91	0.62	0.39	0.30	0.30	0.30	0.30
121÷140	—	1.35	1.00	0.72	0.48	0.30	0.30	0.30	0.30
141÷160	—	1.42	1.07	0.79	0.55	1.35	0.30	0.30	0.30
161÷180	—	1.46	1.12	0.84	0.61	0.41	0.30	0.30	0.30
181÷200	—	—	1.16	0.89	0.65	0.45	0.30	0.30	0.30
201÷220	—	—	1.20	0.92	0.69	0.49	0.31	0.30	0.30
221÷240	—	—	1.23	0.95	0.72	0.52	0.34	0.30	0.30
241÷260	—	—	1.25	0.97	0.74	0.54	0.37	0.30	0.30
261÷280	—	—	1.27	1.00	0.76	0.56	0.39	0.30	0.30
281÷300	—	—	1.29	1.01	0.78	0.58	0.41	0.30	0.30
301÷320	—	—	—	1.23	0.97	0.73	0.53	0.34	0.30
321÷340	—	—	—	1.25	0.99	0.76	0.55	0.36	0.30
341÷360	—	—	—	1.27	1.01	0.78	0.57	0.38	0.30
361÷380	—	—	—	1.29	1.03	0.80	0.58	0.39	0.30
381÷400	—	—	—	1.31	1.05	0.81	0.60	0.41	0.30

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

**Table 11**

Minimum thickness of fire protections of the Flame Stal system – round tubes.

Fire resistance class R 45

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	—	—	1.27	0.90	0.64	0.44	0.30	0.30	0.30
81÷100	—	—	1.38	1.03	0.77	0.57	0.42	0.30	0.30
101÷120	—	—	1.44	1.11	0.85	0.66	0.50	0.37	0.30

Table 11, continued

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
121÷140	—	—	—	1.16	0.91	0.71	0.56	0.43	0.32
141÷160	—	—	—	1.19	0.95	0.76	0.60	0.47	0.37
161÷180	—	—	—	1.22	0.98	0.79	0.63	0.50	0.40
181÷200	—	—	—	1.24	1.00	0.81	0.66	0.53	0.42
201÷220	—	—	—	1.26	1.02	0.83	0.68	0.55	0.44
221÷240	—	—	—	1.28	1.04	0.85	0.70	0.57	0.46
241÷260	—	—	—	1.29	1.05	0.86	0.71	0.58	0.47
261÷280	—	—	—	1.30	1.06	0.87	0.72	0.59	0.49
281÷300	—	—	—	1.31	1.07	0.88	0.73	0.60	0.50
301÷320	—	—	—	—	1.37	1.14	0.95	0.78	0.64
321÷340	—	—	—	—	1.39	1.16	0.97	0.80	0.66
341÷360	—	—	—	—	1.41	1.18	0.98	0.81	0.67
361÷380	—	—	—	—	1.43	1.19	1.00	0.83	0.68
381÷400	—	—	—	—	1.44	1.21	1.01	0.84	0.69

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

Table 12

Minimum thickness of fire protections of the Flame Stal system – round tubes.

Fire resistance class R 60

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
≤80	—	—	—	1.36	1.05	0.83	0.66	0.52	0.41
81÷100	—	—	—	1.44	1.14	0.92	0.75	0.61	0.50
101÷120	—	—	—	1.48	1.19	0.97	0.80	0.67	0.56
121÷140	—	—	—	—	1.22	1.01	0.84	0.71	0.59
141÷160	—	—	—	—	1.25	1.04	0.87	0.73	0.62
161÷180	—	—	—	—	1.27	1.06	0.89	0.76	0.64
181÷200	—	—	—	—	1.28	1.07	0.91	0.77	0.66
201÷220	—	—	—	—	1.30	1.09	0.92	0.79	0.68
221÷240	—	—	—	—	1.31	1.10	0.93	0.80	0.69

Table 12, continued

U/A m <sup>-1</sup>	Minimum thickness of protections after drying*, mm, for critical temp.								
	350°C	400°C	450°C	500°C	550°C	600°C	650°C	700°C	750°C
1	2	3	4	5	6	7	8	9	10
241÷260	—	—	—	—	1.31	1.11	0.94	0.81	0.70
261÷280	—	—	—	—	1.32	1.12	0.95	0.82	0.71
281÷300	—	—	—	—	1.33	1.12	0.96	0.82	0.71
301÷320	—	—	—	—	—	—	1.38	1.19	1.03
321÷340	—	—	—	—	—	—	1.39	1.21	1.05
341÷360	—	—	—	—	—	—	1.41	1.22	1.06
361÷380	—	—	—	—	—	—	1.43	1.24	1.08
381÷400	—	—	—	—	—	—	1.44	1.24	1.09

\* of 0.06 mm thick prime layer, swelling layer and 0.06 mm thick top layer

### 3. TECHNICAL PROPERTIES, REQUIREMENTS

#### 3.1. Paints Carboguard 888 and Carbothane 134 PU

**3.1.1. Technical properties.** The required technical properties of the two-component anticorrosive epoxy paint Carboguard 888 and the two-component top-coat polyurethane paint Carbothane 134 PU are specified in table 13.

**Table 13**

Required technical properties of the paints Carboguard 888 and Carbothane 134 PU

Item	Properties	Requirements		Examinations according to
		Carboguard 888	Carbothane 134 PU	
1	2	3	4	5
1.	External appearance	without skin, phase separation, foreign inclusions and sediment		PN-EN ISO 1513: 1999
2.	Density, g/ml: ▪ component A ▪ component B	1.54 ± 5% 1.47 ± 5%	1.24 ± 5% 1.07 ± 5%	PN-EN ISO 2811-2: 2002 or PN-EN ISO 2811-1: 2002
3.	Apparent viscosity, measured using Brookfield method, mPa·s: ▪ component A ▪ component B	13950 ± 10% (rotor no. 4, speed 10 rpm) 7790 ± 10% (rotor no. 3, speed 10 rpm)	2290 ± 10% (rotor no. 2, speed 10 rpm) 7745 ± 10% (rotor no. 1, speed 10 rpm)	PN-ISO 2555: 1999

Table 13, continued

Item	Properties	Requirements		Examinations according to
		Carboguard 888	Carbothane 134 PU	
1	2	3	4	5
4.	Surface drying time, h	1.5 ± 10%*	1.0 ± 10%**	PN-EN ISO 1517: 1999
5.	Non-volatile substances content, % (weight)	77-86	67-74	PN-EN ISO 3251: 2004

\* coats of (average) thickness 80 µm determined according to the standard PN-EN ISO 2808:2000, method 6A  
 \*\* coats of (average) thickness 40 µm determined according to the standard PN-EN ISO 2808:2000, method 6A

**3.1.2. Usability.** The usability periods of the anticorrosive prime-coat paint Carboguard 888 and the top-coat paint Carbothane 134 PU should be specified on the packaging. The manufacturer guarantees that the products maintain their properties in accordance with the requirements specified in point 3.1.1 during this period.

**3.2. Fire-Protecting Paint Flame Stal®**

**3.2.1. Technical properties.** The technical properties of the fire-protecting paint Flame Stal® should be in accordance with the requirements specified in table 14.

Table 14

Required technical properties of the fire-protecting paint Flame Stal®

Item	Properties	Requirements	Examinations according to
1	2	3	4
1.	External appearance	without skin, phase separation, foreign inclusions and sediment	PN-EN ISO 1513: 1999
2.	Density, g/ml:	1.345 ± 5%	PN-EN ISO 2811-2: 2002 or PN-EN ISO 2811-1: 2002
3.	Apparent viscosity, measured using Brookfield method, mPa·s (rotor no. 5, speed 10 rpm)	25950 ± 10%	PN-ISO 2555: 1999
4.	Non-volatile substances content, %	84-85	PN-EN ISO 3251: 2004
5.	Surface drying time, minutes*	30 ± 10%	PN-EN ISO 1517: 1999
6.	Relative swelling height – multiple of the coat swelling per thickness in relation to the thickness before heating, average value	106 ± 10%	U.A. ITB GS VII.10/2002

\* coats of (average) thickness 200 µm determined according to the standard PN-EN ISO 2808:2007, method 6A

**3.2.2. Usability.** The usability period of the fire-protecting paint Flame Stal® should be specified on the packaging. The manufacturer guarantees that the product maintains its properties in accordance with the requirements specified in point 3.2.1 during this period.

### 3.3. Set of Products of the Flame Stal System

**3.3.1. Technical and operational properties.** The technical and operational properties of the fire protections of the Flame Stal system, executed of the set of painting products according to point 1, should be in accordance with the requirements specified in table 15.

**Table 15**

Required technical and operational properties of the fire protections of the Flame Stal system

Item	Properties	Requirements	Examinations according to
1	2	3	4
1.	Coat appearance	without blisters, coat separation from substrate, and uncoated places	PN-EN ISO 12944-7: 2001 (visual inspection)
2.	Adhesion of the prime paint coat to a steel substrate, determined using the incision grid method, degree	0 or 1	PN-EN ISO 2409: 1999, point 7.2
3.	Adhesion of the products set coat to a steel substrate and interlayer adhesion, determined using the tear off method, MPa	≥2.0 or breaking in the swelling layer	PN-EN ISO 4624: 2004
4.	Resistance to brine mist acting for: <ul style="list-style-type: none"> <li>• 480 h, in the case of environment of corrosiveness category C3</li> <li>• 720 h, in the case of environment of corrosiveness category C4</li> <li>• 1440 h, in the case of environment of corrosiveness category C5-I and C5-M</li> </ul> evaluated by a change of: <ol style="list-style-type: none"> <li>a) external appearance</li> <li>b) adhesion to substrate and interlayer adhesion, MPa</li> </ol>	the coat exhibits no damage for the time of examination ≥2.0 or breaking in the swelling layer	point 5.6.1
5.	Resistance to moisture acting for: <ul style="list-style-type: none"> <li>• 120 h, in the case of environment of corrosiveness category C2</li> <li>• 240 h, in the case of environment of corrosiveness category C3</li> <li>• 480 h, in the case of environment of corrosiveness category C4</li> <li>• 720 h, in the case of environment of corrosiveness category C5-I and C5-M</li> </ul> evaluated by a change of: <ol style="list-style-type: none"> <li>a) external appearance</li> <li>b) adhesion to substrate and interlayer adhesion, MPa</li> </ol>	the coat exhibits no damage for the time of examination ≥3.0 or breaking in the swelling layer	point 5.6.2

Table 15, continued

Item	Properties	Requirements	Examinations according to
1	2	3	4
6.	Chemical resistance (in the case of environment of corrosiveness category C5-I) with the aggressive factors: <ul style="list-style-type: none"> <li>• painter's naphtha acting for 168 h</li> <li>• 10% NaOH acting for 168 h</li> <li>• 10% H<sub>2</sub>SO<sub>4</sub> acting for 168 h</li> </ul> evaluated by a change of: <ol style="list-style-type: none"> <li>a) external appearance</li> <li>b) adhesion to substrate and interlayer adhesion, MPa</li> </ol>	the coat exhibits no damage for the time of examination $\geq 3.0$ or breaking in the swelling layer	point 5.6.3
7.	Coat resistance, $\Omega$ , with brine mist acting for: <ul style="list-style-type: none"> <li>• 480 h, in the case of environment of corrosiveness category C3</li> <li>• 720 h, in the case of environment of corrosiveness category C4</li> <li>• 1440 h, in the case of environment of corrosiveness category C5-I and C5-M</li> </ul>	$\geq 10^7$	point 5.6.4

**3.3.2. Fire-protecting effectiveness of protections of the Flame Stal system.**

The fire resistance of steel elements protected using the Flame Stal system in accordance with the requirements of this Approval, subjected to examination according to point 5.6.5, should be in accordance with the fire resistance specified in point 2.2.3.

**4. PACKAGING, STORAGE, TRANSPORT**

**4.1. Packaging**

The products included in the Flame Stal system set should be packed in proprietary, tightly closed packages, protecting them against spilling and change of the technical and operational properties.

A label should be applied on every package, including at least the following data:

- name and address of the Manufacturer,
- product name according to this Technical Approval ITB,
- net weight,
- usability date,

- information concerning the hazard to health or life, specified in the product data sheet, elaborated in accordance with the decree of the Minister of Health of 3 July 2002 on hazardous substance and hazardous preparation data sheet (Journal of Laws No. 140, item 1171),
- decree of the Minister of Health on marking of packages of hazardous substances and hazardous preparations (Journal of Laws No. 173/2003, item 1679, as amended),
- conditions of storage and transport,
- number of the Technical Approval ITB (AT-15-7324/2007),
- name of the certifying body that participated in the conformity evaluation,
- number of the certificate of conformity,
- number and date of issue of the national declaration of conformity,
- building sign.

The method of marking the product with the building sign should be conforming to the decree of the Minister of Infrastructure of 11 August 2004 on the method of declaration of conformity of building products and the method of marking them with the building sign (Journal of Laws No. 198/2004, item 2041).

#### **4.2. Storage**

The products included in the Flame Stal system set, packed according to point 4.1, should be stored in a way that protects them from change of the technical and operational properties and destruction, specified in storage instructions elaborated by the Manufacturer in Polish language and made available to recipients of the products.

#### **4.3. Transport**

The products included in the Flame Stal system set, packed according to point 4.1, should be transported in a way that protects them from change of the technical and operational properties and destruction, specified in transport instructions elaborated by the Manufacturer, taking into account the Polish regulations regarding the transport of this type of materials. The instructions, in Polish language, should be submitted to recipients of the products.

## 5. CONFORMITY EVALUATION

### 5.1. General Provisions

In accordance with art. 4, art. 5 par. 1 point 3 and art. 8 par. 1 of the act of 16 April 2004 on building products (Journal of Laws No. 92/2004, item 881), the set of products concerned by this Technical Approval may be admitted for commerce and application in building works in the scope corresponding to its operational properties and purpose, if the Manufacturer has performed the conformity evaluation, has issued a national declaration of conformity with the Technical Approval ITB AT-15-7324/2007, and has marked the products with the building sign, in accordance with the regulations in force.

In accordance with the decree of the Minister of Infrastructure of 11 August 2004 on the methods of declaration of conformity of building products and the method of marking them with the building sign (Journal of Laws No. 198/2004, item 2041), the conformity evaluation of the set of products of the Flame Stal system with the Technical Approval AT-15-7324/2007 is performed by the Manufacturer, using the system 1.

In the case of system 1 of the conformity evaluation, the Manufacturer may issue a national declaration of conformity with the Technical Approval AT-15-7324/2007, if an accredited certifying body has issued a product conformance certificate on the basis of:

a) tasks of the Manufacturer:

- factory inspection of production,
- supplementary examinations of finished products (samples) taken in the production plant, performed by the Manufacturer, in accordance with the arranged examination program, including the examinations specified in point 5.4.3,

b) tasks of the accredited body:

- initial type examination,
- initial inspection of the production plant and factory inspection of production,
- continuous supervision, evaluation, and acceptance of the factory inspection of production.

### 5.2. Initial Type Examination

The initial type examination is an examination confirming the required technical and operational properties, performed before the products are admitted to commerce.

The initial type examination of the set of products of the Flame Stal system includes:

- a) adhesion to substrate and interlayer adhesion,

- b) corrosion resistance,
- c) fire resistance class.

The examinations which constituted the basis for determination of the technical and operational properties of the product in the approval procedure, constitute the initial type examination in the conformity evaluation.

### **5.3. Factory Inspection of Production**

The factory inspection of production includes:

- 1) specification of component products and examination of documents confirming the technical and operational properties of the products included in the set,
- 2) inspection and examinations in the manufacturing process and examinations of the finished product (point 5.4.2), performed by the Manufacturer in accordance with the arranged examination program, and according to the rules and procedures specified in the documentation of factory inspection of production, adapted to production technologies and aimed at obtaining products of the required properties.

The production inspection should ensure that the products are conforming to the Technical Approval ITB AT-15-7324/2007. The results of the production inspection should be registered systematically. Records of the register should confirm that the products fulfil the criteria of conformity evaluation. Every batch of products should be unequivocally identified in the examination register.

### **5.4. Examinations of Finished Products**

**5.4.1. Program of examinations.** The program of examinations includes:

- a) current examinations,
- b) supplementary examinations.

**5.4.2. Current examinations.** Current examinations include the inspection of the Flame Stal<sup>®</sup> paint in the scope of:

- a) external appearance,
- b) content of non-volatile substances,
- c) viscosity.

**5.4.3. Supplementary examinations.** Supplementary examinations include the inspection of:

- a) drying time of a coat of the Flame Stal<sup>®</sup> paint,
- b) density of the Flame Stal<sup>®</sup> paint,
- c) adhesion to substrate and interlayer adhesion of the fire protection,
- d) corrosion resistance of the fire protection,
- e) fire-protecting effectiveness of the fire protection.

### 5.5. Frequency of Examinations

Current examinations should be performed in accordance with the arranged examination program, but at least once on every batch of products. The size of the batch of products should be specified in the documentation of factory inspection of production.

Supplementary examinations should be performed at least once per three years.

### 5.6. Methods of Examinations

The examinations should be performed in accordance with the requirements of the documents mentioned in column 5 of table 13 and column 4 of table 14 and table 15, respectively, and in accordance with the rules specified in point 5.6.1-5.6.5.

The obtained results should be compared with the requirements specified in column 4 of table 13 and column 3 of table 14 and table 15, respectively.

**5.6.1. Examination of resistance to brine mist.** The examination of resistance of the protection, executed in accordance with the requirements of point 5.7, to the influence of brine mist is performed according to the standard PN-EN ISO 9227: 2006. The following checks are made after examination:

- external appearance of the coat according to the standard PN-EN ISO 4628-2: 2005,
- adhesion to substrate and interlayer adhesion, using the tear off method according to the standard PN-EN ISO 4624: 2004.

**5.6.2. Examination of resistance to moisture.** The examination of resistance of the protection, executed in accordance with point 5.7, to the influence of moisture is performed according to the standard PN-EN ISO 6270-1: 2002. The following checks are made after examination:

- external appearance of the coat according to the standard PN-EN ISO 4628-2: 2005,
- adhesion to substrate and interlayer adhesion, using the tear off method according to the standard PN-EN ISO 4624: 2004.

**5.6.3. Examination of chemical resistance (in the case of environment of corrosiveness category C5-I).** The examination of chemical resistance of the protection, executed in accordance with point 5.7, is performed by subjecting samples for 168 h to the action of aggressive factors:

- painter's naphtha,
- 10% NaOH,
- 10% H<sub>2</sub>SO<sub>4</sub>.

The following checks are made after examination:

- external appearance of the coat according to the standard PN-EN ISO 4628-2: 2005,
- adhesion to substrate and interlayer adhesion, using the tear off method

according to the standard PN-EN ISO 4624: 2004.

**5.6.4. Examination of coat resistance.** The examination of resistance (impedance parameter), being the indicator of tightness of the painting coat, is performed using the method of electrochemical impedance spectroscopy EIS for the system: metal – coat – electrolyte in AC circuits, in a wide range of frequencies, according to ZUAT-15/VI.01/2003.

**5.6.5. Examination of fire-protecting effectiveness.** The examination and evaluation of fire-protecting effectiveness of the protection of the Flame Stal system, executed of the paints set in accordance with point 2.2, has been determined according to the standards PN-ENV 13381-4: 2004 and PN-EN 13501-2: 2005.

In order to check the suitability of the Flame Stal system for application outside of buildings, before the fire examination the fire protection has been subjected to 21 cycles of variable temperature and humidity factors, each including in sequence:

- 4 hours – temperature -20°C,
- 4 hours – temperature +20°C and relative humidity 80%,
- 16 hours – temperature 40°C and relative humidity 50%.

Supplementary examinations are performed at thermal action according to the standard “temperature – time” curve, in one fire test, on a set of 3 non-loaded pillars of length 1000 mm, executed of rolled double-tee bars, with applied fire-protecting insulation being examined, of thickness assumed on the basis of the requirements of the Technical Approval. The examination result is considered as positive if the temperature in all test elements after the time corresponding to the fire resistance does not exceed the critical temperature, specified in respective table of the Technical Approval.

### **5.7. Taking and Preparing Samples for Examinations**

The samples of paint for examinations should be taken in accordance with the rules specified in the standard PN-EN ISO 15528: 2002.

The samples of paints for examinations should be prepared according to the standard PN-EN ISO 1513: 1999.

The plates should be painted in accordance with the conditions of application of the set of products for executing the fire protection of the Flame Stal system according to point 2.2.

### **5.8. Evaluation of Examination Results**

The fire-protecting paint Flame Stal<sup>®</sup> and the completed set of products of the Flame Stal system may be regarded as conforming to the requirements of this Technical Approval ITB, if the results of all examinations are positive.

## 6. FORMAL AND LEGAL PROVISIONS

**6.1.** The Technical Approval ITB AT-15-7324/2007 is a document certifying the suitability of the products of the Flame Stal system for executing fire protections of steel and galvanised steel structures for application in the building industry in the scope resulting from the provisions of the Approval.

In accordance with art. 4, art. 5 par. 1 point 3 and art. 8 par. 1 of the act of 16 April 2004 on building products (Journal of Laws No. 92/2004, item 881), the set of products concerned by this Technical Approval may be admitted for commerce and application in building works in the scope corresponding to its operational properties and purpose, if the Manufacturer has performed the conformity evaluation, has issued a national declaration of conformity with the Technical Approval ITB AT-15-7324/2007, and has marked the products with the building sign, in accordance with the regulations in force.

**6.2.** The Technical Approval ITB does not infringe the rights resulting from the regulations on protection of industrial property, and in particular the notice of the Speaker of the Sejm of the Republic of Poland of 13 June 2003 on announcement of the uniform text of the Industrial Property Law act of 30 June 2000 (Journal of Laws no. 119, item 1117). Assurance of these rights is the responsibility of the users of this Technical Approval.

**6.3.** Issuing the Technical Approval, the ITB assumes no responsibility for possible infringement of exclusive or acquired rights.

**6.4.** The Technical Approval does not exempt the Manufacturer from the responsibility for proper quality of the products included in the set for executing fire protections of the Flame Stal system, and the contractors of fire protections from the responsibility for their proper application.

**6.5.** The content of issued prospects and advertisements and other documents related to admission to commerce and application in the building industry of the set of products for executing fire protections of the Flame Stal system should include information about the issued Technical Approval ITB AT-15-7324/2007.

## 7. EXPIRATION DATE

The Technical Approval ITB AT-15-7324/2007 is valid till 20 June 2012.

The validity of the Technical Approval ITB may be prolonged to consecutive periods of time, if its Applicant, or their formal successor, brings forward a suitable application to the Building Research Institute no later than 3 months before the expiration date of this document.

**THE END**

## ADDITIONAL INFORMATION

### Related standards and documents

PN-EN 1363-1: 2001	<i>Fire resistance examination. Part 1: General requirements</i>
PN-EN 13501-2: 2005	<i>Fire classification of building products and building elements. Part 2: Classification based on fire resistance examinations, exclusive of ventilation system</i>
PN-ENV 13381-4: 2004	<i>Examination methods for determination of the influence of protections on fire resistance of structural elements. Part 4: Protections of steel elements</i>
PN-EN ISO 1513: 1999	<i>Paints and lacquers. Inspection and preparation of samples for examination</i>
PN-EN ISO 1517: 1999	<i>Paints and lacquers. Examination of surface drying. Method with glass marbles</i>
PN-EN ISO 2409: 1999	<i>Paints and lacquers. Incision grid method</i>
PN-EN ISO 2808: 2002	<i>Paints and lacquers. Determination of coat thickness</i>
PN-EN ISO 3251: 2004	<i>Paints and lacquers. Determination of non-volatile substances content</i>
PN-EN ISO 4624: 2004	<i>Paints and lacquers. Tearing off test for adhesion evaluation</i>
PN-ISO 2555: 1999	<i>Plastics. Liquid polymers in emulsion or dispersion form. Determination of apparent viscosity using the Brookfield method</i>
PN-EN ISO 2811-1: 2002	<i>Paints and Lacquers. Determination of density. Part 1: Pycnometric method</i>

- PN-EN ISO 2811-2: 2002 *Paints and Lacquers. Determination of density. Part 2: Probe submersion method*
- PN-EN ISO 4628-2: 2005 *Paints and lacquers. Coat damage evaluation. Determination of the quantity and size of damage and intensiveness of uniform changes in appearance. Part 2: Evaluation of the degree of blistering*
- PN-EN ISO 6270-1: 2002 *Paints and lacquers. Determination of resistance to moisture. Part 1: Continuous condensation*
- PN-EN ISO 9227: 2006 *Corrosion examinations in artificial atmospheres. Examinations in sprayed brine*
- PN-EN ISO 12944-2:2001 *Paints and lacquers. Corrosion protection of steel structures using protective painting systems. Part 2: Classification of environments*
- PN-EN ISO 12944-4:2001 *Paints and lacquers. Corrosion protection of steel structures using protective painting systems. Part 4: Types of surfaces and methods of surface preparation*
- PN-EN ISO 12944-7:2001 *Paints and lacquers. Corrosion protection of steel structures using protective painting systems. Part 7: Execution and supervision of painting works*
- PN-EN ISO 15528: 2002 *Paints, lacquers and raw materials for paints and lacquers. Taking samples*
- PN ISO 8501-1: 1996 *Preparation of steel substrates before application of paints or similar products. Visual evaluation of surface cleanliness. Degrees of corrosion and degrees of preparation of unprotected steel substrates and steel substrates after complete removal of coats applied earlier*
- ZUAT-15/VII.05/2004 *Recommendations for Issuing Technical Approvals ITB. Sets of painting products for fire-protecting of steel structures. Recommendations for Issuing Technical Approvals, Building Research Institute, Warsaw 2004*
- ZUAT-15/VI.01/2003 *Recommendations for Issuing Technical Approvals ITB. Painting products for corrosion protection of steel structures. Recommendations for Issuing Technical Approvals, Building Research Institute, Warsaw 2004*
- GS VII.10/2002 *Approval Arrangements concerning the required properties and methods of examination of thermally activated sealing products applied due to fire safety. Building Research Institute, Warsaw*

**Examination Procedures ITB**

- LO-17 *Impedance examination. Determination of impedance parameters of painting coats and coverings on metals and metallic products using the electrochemical impedance spectroscopy (EIS) method*
- LO-27 *Determination of resistance of coats to tearing off the substrate. Supplementary procedure to the standard PN-EN ISO 2409:1999. Paints and lacquers. Incision grid method*
- LO-30 *Determination of apparent viscosity using the Brookfield method. Supplementary procedure to the standard PN-ISO 2555. Plastics. Liquid polymers in emulsion or dispersion form. Determination of apparent viscosity using the Brookfield method*
- LO-35 *Determination of resistance of coats to brine mist. Supplementary procedure to the standard PN-ISO 7253. Paints and lacquers. Determination of resistance to sprayed inert brine (mist)*
- LP-32.1 *Periodical inspection of fire-protecting effectiveness of insulations of steel structures*

**Reports on examinations and evaluations**

1. NP-946/A/06/MŁ. *Evaluation of fire-protecting effectiveness of the set of painting products Flame Stal for fire-protecting of steel structures.* Building Research Institute, Department of Fire Research, Warsaw
2. FIRES-FR-048-07-AUNS. Report on examination of fire-protecting effectiveness of the set of paints Flame Stal®. Fires Laboratory, Slovakia, 2007
3. LP-946/36-2/06. Report on examination of the swelling height of the coat of the Flame Stal® paint. Building Research Institute, Department of Fire Research, Warsaw
4. NO-2/1031/C/2006. *Results of examination of corrosion resistance of the fire-protecting set of the A+B Polska company for corrosive environments C1-C5 with the Report on examination NR LO 941/07.* Building Research Institute, Department of Durability and Protection of Buildings, Warsaw
5. NO-2/595/P/2007. *Opinion on the possibility to use the swelling paint FLAME STAL in a set with various epoxy prime-coat paints and polyurethane top-coat paints.* Building Research Institute, Department of Durability and Protection of Buildings, Warsaw
6. Supplementary opinion to the opinion no. NO-2/595/P/2007. Building Research Institute, Department of Durability and Protection of Buildings, Warsaw
7. HK/B/1195/02/2004, HK/B/0740/01/2007, HK/B/0740/02/2007. Hygienic Certificates. National Institute of Hygiene, Department of Environmental Hygiene, Warsaw 2004