DNV·GL

Certificate No:
TAF00000G4

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Structural Fire Protection

with type designation(s)
Pyroclad X1 - I section

Issued to
Carboline Company
St. Louis MO, United States

is found to comply with
DNV GL offshore standards

Application :

Approved for use as a system for fire protection of structural steel I sections.

Product approved by this certificate is accepted for installation on all vessels classed by DNV GL.

This Certificate is valid until **2021-12-02**.

Issued at **Høvik** on **2016-12-03**
DNV GL local station: **Houston** for **DNV GL**

Approval Engineer: **Tomasz Werchowicz**

Petter Langnes
Head of Section

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

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Product description

"Pyroclad X1 - I section"
The system is composed by a primer covered by a 2 part epoxy mastic fire barrier (Pyroclad X1). The intumescent coating is reinforced at approx. 2/3 of desired thickness with high temperature fabric (HTF) with overlap or steel wire mesh (GHC) fixed with pins.

Wet density of Pyroclad X1 is 1035-1110 kg/m^3.

The materials are manufactured at the premises of Carboline Company, 95 Airpark Vista Blvd, Dayton, NV 89403, USA

Application/Limitation

The thickness of "Pyroclad X1" system to be applied to avoid temperatures to rise on the steel substrate less than 200ºC, 250ºC, 300 ºC, 350ºC, 400ºC, 450ºC, 500ºC, 550ºC and 600ºC for 'I" sections, are given in appendix table 1-9.

The protective coating is not defined as non-combustible and should not be used in accommodation or in enclosed areas.

Potential damage of the structural fire protection material following an explosion has not been considered.

Minimum fabric overlap shall be not less than 50 mm.

The approval refers only to the fire resistance properties of the system.

The application of the protective coating is to be performed in accordance with the manufacturer's application manual. Alternative primers and topcoats may be used provided they have been tested and approved by the manufacture.

Each product is to be supplied with its manual for application and maintenance.

Type Approval documentation

Certification in accordance with Class Programme DNVGL-CP-0338, October 2015.

Pyroclad X1 Fire Barrier System Application Manual, Rev.0, dated October 2012 from Carboline Co., St. Louis, US.

Technical Note 071912 dated 19th July 2012 from Carboline Co., St. Louis, US.

Test Report No. 100463890SAT-011 dated 23rd July 2012 from Intertek Evaluation Center, Texas, US
Test Report No. 100463890SAT-016 dated 16th June 2012 from Intertek Evaluation Center, Texas, US

Evaluation No. 101513920SAT-008 dated 10th June 2014 from Intertek Testing Services, Texas, US

Tests carried out

Tested according to BS 476: Part 20 with HC-curve according to ISO 834-3.

Marking of product

The product is to be marked with name of manufacturer, type designation and fire-technical rating

Periodical assessment

DNV GL's surveyor is to be given permission to perform Periodical Assessments at any time during the validity of this certificate and at least every second year. The arrangement is to be in accordance with procedure described in Class Programme DNVGL-CP-0338, Section 4.

Job Id:
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Table 1: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **200°C:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
50									205							
55									210							
60									215							
65									220							
70									225							
75									230							
80									235							
85									240							
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105									260							
110									265							
115									270							
120									275							
125									280							
130									285							
135									290							
140									295							
145									300							
150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]

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Table 2: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **250ºC:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
50									205							
55									210							
60									215							
65									220							
70									225							
75									230							
80									235							
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110									265							
115									270							
120									275							
125									280							
130									285							
135									290							
140									295							
145									300							
150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]

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Table 3: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **300ºC:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
50									205							
55									210							
60									215							
65									220							
70									225							
75									230							
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115									270							
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125									280							
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135									290							
140									295							
145									300							
150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]

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Table 4: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **350ºC:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
50									205							
55									210							
60									215							
65									220							
70									225							
75									230							
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150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]

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Table 5: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **400ºC:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
50									205							
55									210							
60									215							
65									220							
70									225							
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120									275							
125									280							
130									285							
135									290							
140									295							
145									300							
150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]

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Table 6: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **450ºC:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
50									205							
55									210							
60									215							
65									220							
70									225							
75									230							
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95									250							
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120									275							
125									280							
130									285							
135									290							
140									295							
145									300							
150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]

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Table 7: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **500ºC:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
50									205							
55									210							
60									215							
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145									300							
150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]

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Table 8: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **550ºC:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
50									205							
55									210							
60									215							
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140									295							
145									300							
150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]

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Table 9: Thickness of "PYROCLAD X1" system for fire protection of "*I*" sections for a critical temperature rise of **600ºC:**

Hp/A	Fire resistance time in minutes, Thickness in mm															
[m-1]	30	60	90	120	150	180	240		[m-1]	30	60	90	120	150	180	240
30									185							
35									190							
40									195							
45									200							
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145									300							
150									305							
155									310							
160									315							
165									320							
170									325							
175									330							
180																

The maximum thickness of protection material up to the required Hp/A [m^{-1}] shall be used.

Hp/A = Ratio between Heat perimeter and cross sectional Area of the section, [m^{-1}]