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Prepared for:

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Summary letter for determining the contribution of protection system to the fire resistance of concrete beam members

To ensure the reinforced concrete beams in buildings have the required fire resistance ability, the beam thickness and the thickness of concrete cover to the rebars must not be less than a certain level in accordance with EN 1992-1 Part 2. In the cases where the thickness of beam or concrete cover in existing reinforced concrete beam is deficient, it is possible to improve the fire resistance by applying intumescent paint system to the beam. This letter presents a summary of the assessment of an intumescent coating system known as HENSOTHERM 820 KS to fire protect structural concrete beams in accordance with EN 13381-3:2015 for periods of fire resistance up to 150 minutes.

The required minimum concrete cover is determined from BS EN 1992-1-2 Table 5.5. Generally when the overall beam thickness is equal or greater than those values, the load bearing capacity of the beam is deemed to be satisfied; while when the concrete cover over the rebar is deficient it is necessary to improve the protection to meet the appropriate load bearing capacity.

The required dry film thickness (DFT) of HENSOTHERM 820 KS to remedy the concrete cover deficiency is summarised in the tables below using linear interpolation avoiding non-conservative predictions against depth inside concrete beam along vertical axis at which steel reinforcing bars are positioned, with a predefined failure temperature of 500°C of the reinforcing bars. It is understood that the temperature distribution (where rebar location is concerned) can be affected by the actual thickness of the reinforced concrete slab, however this variation is considered limited given the overall insulation performance will be met by the minimum required beam thickness. Therefore this variation has not been taken into account in this letter.

The data in the tables is based on the tests reports WF nos. 330452 and 328733 and assessment report 339816, with the following limits of applicability.

- 1) The concrete cover prior to application of protection should meet the requirements in BS EN 1992-1 Part 1.
- 2) Consult Rudolf Hensel for the requirements of preparation of the concrete base prior to application of HENSOTHERM 820 KS.
- 3) The load ratio of the beam in fire condition should be not greater than 0.6
- 4) The results presented in this letter are based on the fire protection system tested in horizontal orientation on concrete beams. Therefore, following the EN 13381-3:2015 Clause 15, the results are applicable to all beams and columns, in use in both horizontal and vertical orientation
- 5) Other limits of applicability in EN 13381-3:2015 (e.g. Clause 15)

Table 1. Required 'HENSOTHERM 820 KS' dry film thickness to improve fire resistance of the reinforced concrete beam for the period of 30 minutes.

30 minutes fire resistance period	
Depth of the reinforcing bar inside concrete beam along vertical axis, mm	Required 'HENSOTHERM 820 KS' dry film thickness for the 500°C design reinforcing bar temperature, mm
< 15	0.450
≥ 15	No protection required

Table 2. Required 'HENSOTHERM 820 KS' dry film thickness to improve fire resistance of the reinforced concrete beam for the period of 60 minutes.

60 minute fire resistance period	
Depth of the reinforcing bar inside concrete beam along vertical axis, mm	Required 'HENSOTHERM 820 KS' dry film thickness for the 500°C design reinforcing bar temperature, mm
4	1.667
5	1.261
6	0.856
Between 7 and 30	0.450
≥ 30	No protection required

Table 3. Required 'HENSOTHERM 820 KS' dry film thickness to improve fire resistance of the reinforced concrete beam for the period of 90 minutes.

90minute fire resistance period	
Depth of the reinforcing bar inside concrete beam along vertical axis, mm	Required 'HENSOTHERM 820 KS' dry film thickness for the 500°C design reinforcing bar temperature, mm
4	1.667
5	1.603
6	1.539
7	1.475
8	1.411
9	1.347
10	1.283
20	0.642
22	0.514
Between 23 and 40	0.450
≥ 40	No protection required

Table 4. Required 'HENSOTHERM 820 KS' dry film thickness to improve fire resistance of the reinforced concrete beam for the period of 120 minutes.

120 minute fire resistance period	
Depth of the reinforcing bar inside concrete beam along vertical axis, mm	Required 'HENSOTHERM 820 KS' dry film thickness for the 500°C design reinforcing bar temperature, mm
4	1.667
5	1.634
6	1.601
7	1.568
8	1.535
9	1.503
10	1.470
20	1.141
30	0.812
40	0.483
Between 41 and 55	0.450
≥ 55	No protection required

Table 5. Required 'HENSOTHERM 820 KS' dry film thickness to improve fire resistance of the reinforced concrete beam for the period of 150 minutes.

150 minute fire resistance period	
Depth of the reinforcing bar inside concrete beam along vertical axis, mm	Required 'HENSOTHERM 820 KS' dry film thickness for the 500°C design reinforcing bar temperature, mm
6	1.667
7	1.644
8	1.620
9	1.597
10	1.573
20	1.339
30	1.105
40	0.871
50	0.637
55	0.520
Between 58 and 60	0.450
≥ 60	No protection required

We trust that the information presented in this letter will be useful to you.

Yours sincerely



Dmitrij Podolski
Senior Certification Engineer
For and behalf of
Exova Warringtonfire

24th August 2018: Issue 2 – editorial changes and addition of the statement allowing application of results to columns.

This assessment represents our opinion as to the performance likely to be demonstrated on a test in accordance with prEN 13381-3:2012, on the basis of the evidence referred to above. We express no opinion as to whether that evidence, and/or this assessment, would be regarded by any Building Control authority as sufficient for that or any other purpose. This assessment is provided to the client for its own purposes and we cannot opine on whether it will be accepted by Building Control authorities or any other third parties for any purpose.

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