

Assessment report for steel/concrete composite beam

Executive summary

DBI – Danish Institute of Fire and Security Technology has been requested by Rockwool A/S to assess a steel/concrete composite beam of profile type SWT, HSQ, Delta or Peikko insulated underneath with 20 mm Conlit 150 mineral wool boards.

It is the opinion of DBI that a loadbearing steel/concrete composite beam insulated underneath with 20 mm Conlit 150 mineral wool boards, fixed to the steel profiles with 2.7 mm welding pins and 28 mm washers, with a pin distance of max. 425 mm and placed max. 50 mm from the edges, has a fire performance equal to a loadbearing beam with the classification R120 as long as the ratio between the design load in the ultimate limit state and the design load in the limit state in case of fire is lower than 0.9.

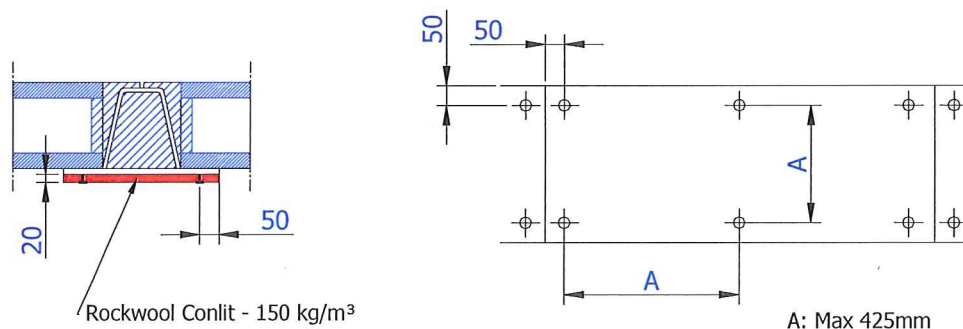
DBI refers to the subsequent text which gives insight into the underlying reasons for this assessment.

Full text assessment

DBI – Danish Institute of Fire and Security Technology has been requested by Rockwool A/S to assess a steel/concrete composite beam insulated underneath with 20 mm Conlit 150/150P mineral wool boards.

Product

A steel/concrete composite beam – a steel beam with concrete cast inside and around the steel. The steel beam is a profile type SWT, HSQ, Delta, Peikko or similar. The exposed under flange of the steel beam is insulated with 20 mm Conlit 150 mineral wool board with nominal density of 165 kg/m^3 and a minimum density of 150 kg/m^3 .



Basis for the assessment:

- 1) Test report PGA10093, dated 2012-03-16: fire test according to ENV 13381-4:2002 and prEN 13381-4:2010 of two loaded beams and two unloaded references.
- 2) Test report PG12257, dated 2011-06-16: fire test essentially according to EN 1365-2 "Fire resistance tests for loadbearing elements – Part 2: Floors and Roofs".
- 3) Assessment PH13525, dated 2012-06-06: assessment concerning the fire performance of steel/concrete composite beams.
- 4) Calculation done by Per Knudsen, dated 2012-05-10: The full contents of the calculation are known to DBI but have been omitted from this assessment by request of Rockwool A/S.

Assessment:

It is the opinion of DBI that a loadbearing steel/concrete composite beam insulated underneath with 20 mm Conlit 150 mineral wool boards, fixed to the steel profiles with 2.7 mm welding pins and 28 mm washers, with a pin distance of max. 425 mm and placed max. 50 mm from the edges, has a fire performance equal to a loadbearing beam with the classification R120.

DBI specifies the following conditions which are preconditions for the expressed opinion.

- A relevant dimensioning according to the Eurocode is done for the steel/concrete composite beam.
- The concrete cast inside and around the steel beam have a density of at least 2300 kg/m³.
- The exposed under flange is in close contact with the concrete. It is between 6 and 25 mm thick and has a width between 380 and 680 mm.
- $\eta_{fi} \leq 0.9$
 η_{fi} is the relation between the design load in the ultimate limit state and the design load in the limit state in case of fire. This relation is calculated as $\eta_{fi} = E_{d,fi}/E_d$, where E_d is the design load in the ultimate limit state and $E_{d,fi}$ is the design load in the limit state in case of fire.

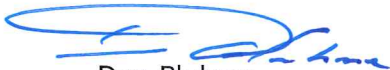
Remarks:

This is an expressed opinion based on the above mentioned reports and calculations.

DBI refers to assessment PH13525 for further details.

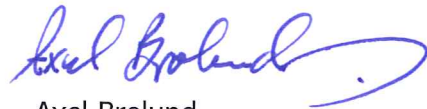
Any changes in the product or the mounting will invalidate this assessment.

DBI - Danish Institute of Fire and Security Technology



Dan Bluhme

M.Sc. (Civ. Eng.)



Axel Brolund

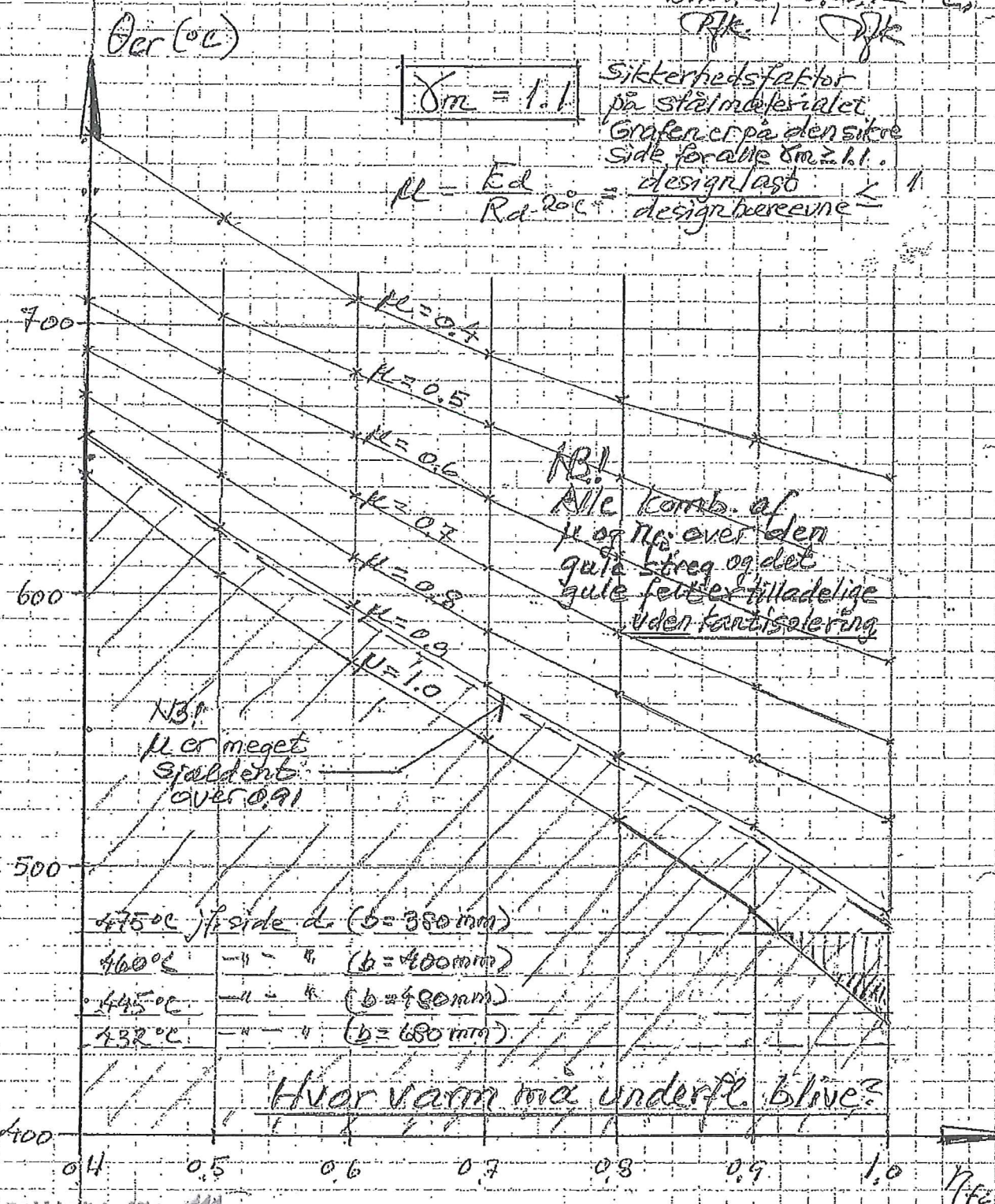
M.Sc. (Civ. Eng.)

Enclosure:

- η_{fi} – temperature graph taken from the calculation done by Per Knudsen, dated 2012-05-10 (stamped and signed by DBI)
- Mounting and fixing guide (stamped and signed by DBI)

Kiel Bolund

29.05.12 10.05.12
 PKK PKK



$$\eta_{fi} = \frac{\text{designlast brand}}{\text{designlast kold}}$$

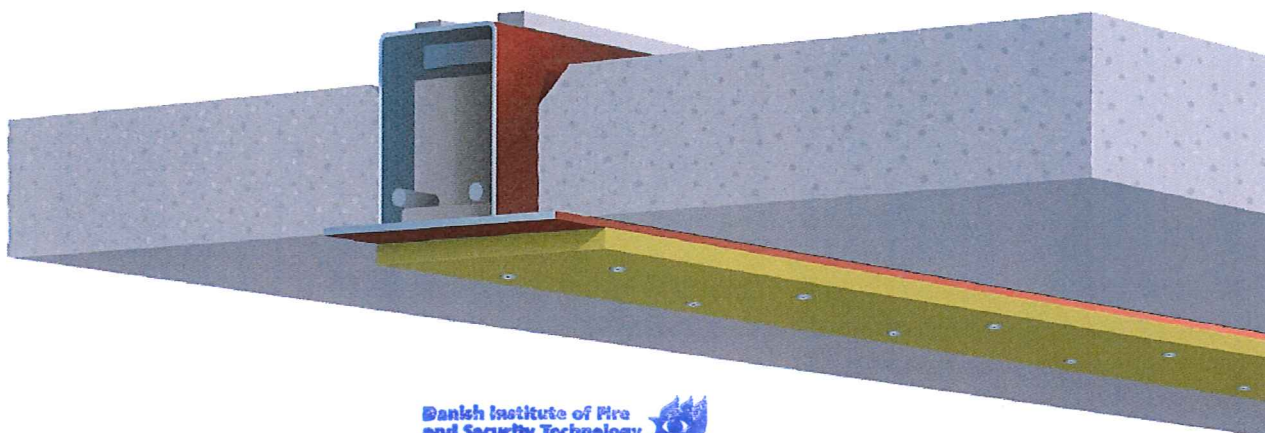
$$\gamma_{m,fi} \cdot \frac{\eta \cdot \eta_{fi}}{\gamma_m} = k_{90} = \text{tilladelig svæffelsesfaktor under brand, } E_{stål} = 2\%$$

$\gamma_{m,fi} = 1$ iflg. det danske nationale appendiks.

R 120

Fire protection of steel/concrete composite beams with Conlit 150/150P

Mounting and fixing guide



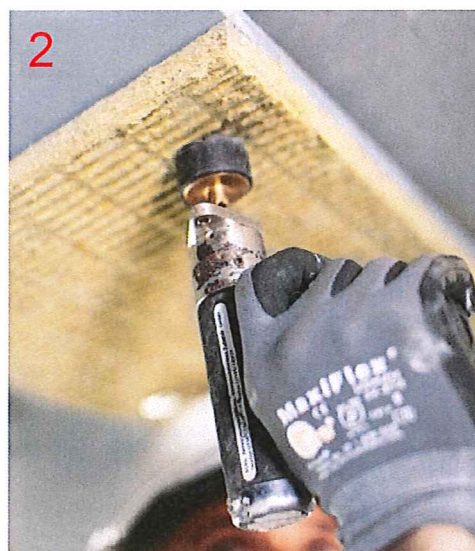
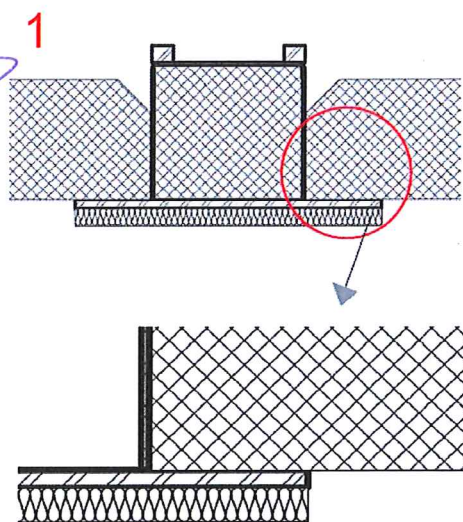
Danish Institute of Fire
and Security Technology

File no. PHA10332 b

Arvid Bohm

R 120 composite steel beams (SWT/HSQ/Peikko/Delta)

1. The fire protection covers all types of composite steel beams within the below limits:
Flange thickness 6-25 mm
Flange wide min. 380 mm
 $\eta_{fi} \leq 0,9$
2. Conlit 150/150P with a thickness of 20mm is used
3. The Conlit boards are cut in the same wide as the exposed under flange. It is not necessary to have a wider Conlit board than the flange and it is not necessary to insulate the sides of the flange (1).
4. The Conlit board is fixed with welding pins. Diameter 2,7 mm and min. 28 mm washers (2).
5. The max. pin distance should be 425mm and placed max 50mm from the edges.



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