



REPORT

Swedish Board for Accreditation and Conformity Assessment

Date
2006-05-02

Reference
P601187A

Page
1 (3)



Handled by department:

Marina C Andersson

Fire Technology

+46 33 16 52 92, marina.andersson@sp.se

egge taepper-sverige AB

Engelbrektsgratan 28

411 37 GÖTEBORG

Fire protection on railway vehicles – Requirements for fire behaviour of materials and components according to prEN 45545-2:2004

(4 appendices)

Product

Carpet called "highline 80 20 1400 wt", consisting of tufted cut pile of 80 % wool and 20 % polyamide and backing of woven textile. The product has a nominal area weight of 2.70 kg.m² and a nominal thickness of 8.7 mm.

Manufacturer

egge taepper – sverige AB, Göteborg, Sweden.

Purpose of test

Basis for technical fire classification.

Sampling

The sample was delivered by the client. It is not known to SP Fire Technology if the product received is representative of the mean production characteristics.

The sample was received April 7, 2006 at SP Fire Technology.

Test results

The test results are given in appendix 1 - 3.

The test results relate only to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

SP Swedish National Testing and Research Institute

Postal address
SP
Box 857
SE-501 15 Borås
SWEDEN

Office location
Vasterasen
Brinnegatan 4
Borås

Phone / Fax / E-mail
+46 33 16 50 00
+46 33 13 55 02
info@sp.se

Laboratories are accredited by the Swedish Board for Accreditation and Conformity Assessment (SWEDAC) under the terms of Swedish legislation. This report may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.

Criteria

According to requirements R9, for floor composite in prEN 45545-2:2004, section 5.3, floor composite is classified as class HL2 if in three tests according to EN ISO 9239-1 and EN ISO 5659-2 the following criteria are met:

Method	Conditions / Parameter	Criteria
EN ISO 9239-1	CHF (kW/m ²)	≥ 4,5
EN ISO 5659-2	25 kW/m ² / D, max	≤ 300
EN ISO 5659-2	25 kW / m ² / CIT at 8 min	≤ 0,9

According to requirements R9, for floor composite in prEN 45545-2:2004, section 5.3, floor composite is classified as class HL4 if in three tests according to EN ISO 9239-1, EN ISO 5659-2 and ISO 5660-1 the following criteria are met:

Method	Conditions / Parameter	Criteria
EN ISO 9239-1	CHF (kW/m ²)	≥ 4,5
EN ISO 5659-2	25 kW/m ² / D, max	< 300
EN ISO 5659-2	25 kW/m ² / CIT at 8 min	≤ 0,9
ISO 5660-1	25 kW/m ² / MARIE	≤ 50

The standard is a draft standard and can be subjected to changes.



Assessment

The tested product called "highline 80 20 1400 wt", when glued to a plywood having a nominal density of 450 kg/m³, meets the technical fire requirements for class III 2, according to the criteria mentioned above.

Deviation from standard

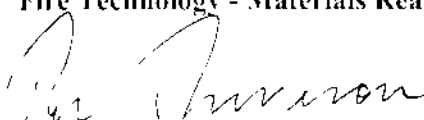
Only three tests at one mode, 25 kW/m², were carried out, instead of the three in three modes stipulated in the standard ISO 5659-2. Three tests at one mode follows the requirements according to prEN 45545-2:2004.


The sampling for FTIR – gas analysis was done during the whole test period instead of the stipulated 20 seconds with start at 7 min and 50 seconds from test start. This was due to that the sampling-line in the FTIR – equipment will not be filled up completely during only 20 seconds sampling time. Due to the long sampling time the sample flow rate was decreased to 2 l/min instead of 4 l/min.

Note

The accreditation referred to in this report is valid for the testing according to EN ISO 9239-1, EN ISO 5659-2 and ISO 5660-1.

SP Swedish National Testing and Research Institute Fire Technology - Materials Reaction to Fire


Per Thureson
Technical Manager


Marina C Andersson
Technical Officer

Appendices

- 1 Test results EN ISO 9239-1
- 2 Test results EN ISO 5659-2
- 3 Test results ISO 5660-1
- 4 Explanation of parameters – ISO 5660



Appendix 1

Test results – EN ISO 9239-1, January 2002**Product**

Carpet called "highline 80/20 1400 wt", consisting of tufted cut pile of 80 % wool and 20 % polyamide and backing of woven textile. The product has a nominal area weight of 2.70 kg m² and a nominal thickness of 8.7 mm.

Application

The specimen was glued to a plywood, having a density of 450 kg m³ and nominal thickness of 12 mm approximately, with glue primer "Casco Drag Loss Primer 3443", glue primer amount 85 g m² approximately and glue "Casco Proff Solid 3480", glue amount 370 g m² approximately.

Test results

Test no	1	2	3	4
Direction	↑	→	↑	↑
Flame spread distance, mm	Time, min:s	Time, min:s	Time, min:s	Time, min:s
50	2:00	2:01	2:03	2:03
100	2:15	2:16	2:15	2:15
150	2:51	2:48	2:45	2:48
Flames at flame front extinguished	3:27	3:22	3:32	3:24

Test no	1	2	3	4
Direction	↑	→	↑	↑
Time, min	Flame spread distance, mm	Flame spread distance, mm	Flame spread distance, mm	Flame spread distance, mm
HF-10	70	70	80	110
HF-20	-	-	-	-
HF-30	-	-	-	-



Appendix 1

Test no	1	2	3	4	Average value*
Direction	↑	→	↑	↑	
Maximum flame spread, mm	180	160	170	180	-
Critical radiant flux (CHF), kW m ²	10.0	10.2	10.1	10.0	<u>10.0</u>

* The mean value for the critical flux is from the test data on the three specimens with the same directional orientation.

Measured data

Thickness 7.8 -- 8.3 mm.
Area weight 3.0 -- 3.5 kg/m².

Conditioning

According to EN 13238, 2000.

Temperature (23 ± 2) °C.
Relative humidity (50 ± 5) %.

Date of test

April 27, 2006.



Test results - ISO 5659-2, 1994

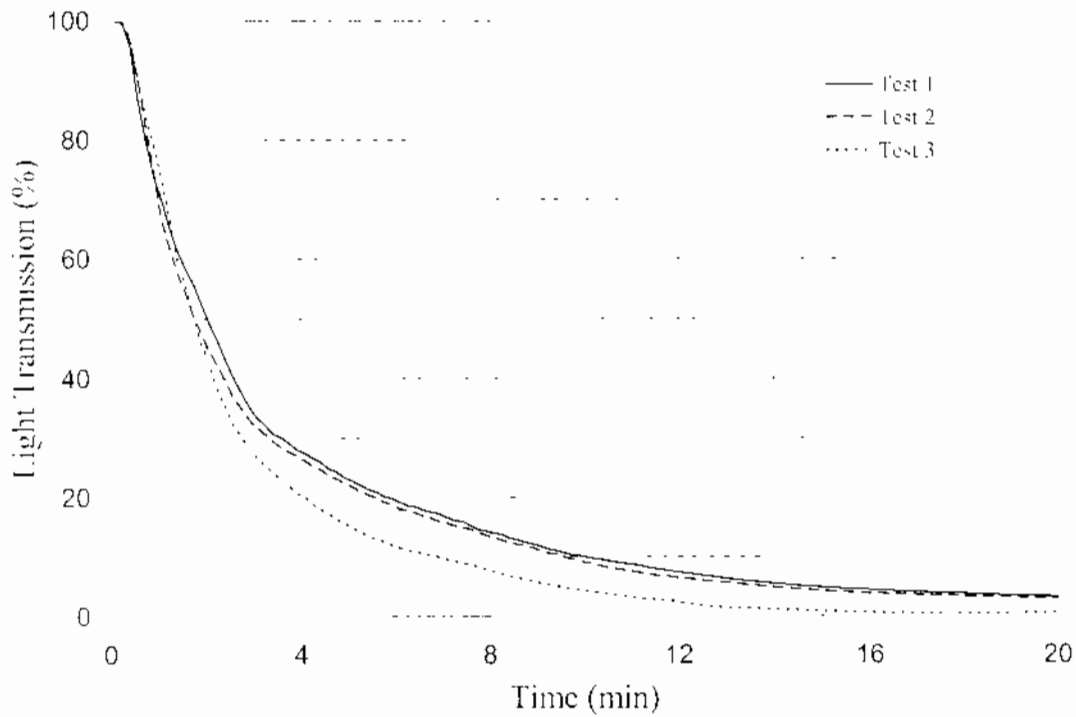
Product

Carpet called "highline 80 20 1400 wt", consisting of tufted cut pile of 80 % wool and 20 % polyamide and backing of woven textile. The product has a nominal area weight of 2.70 kg m² and a nominal thickness of 8.7 mm.

Application

The specimen was glued to a plywood, having a density of 450 kg/m³ and nominal thickness of 12 mm approximately, with glue primer "Casco Drag Loss Primer 3443", glue primer amount 85 g/m² approximately and glue "Casco Proff Solid 3480", glue amount 370 g/m² approximately.

Light Transmission – Flaming exposure (Irradiance 25 kW/m²)





Appendix 2

Smoke results

Mode	Irradiance 25kW m ⁻² . Flaming exposure			
Test no	1	2	3	Mean
D _{max}	199	203	316	239 (D ₅₀)
D ₁₀	133	138	181	150
D ₅	2	2	38	
Duration of test, s	1200	1200	1200	

Note

One of the specimens tested in mode 1 (Irradiance 25 kW/m², Flaming exposure) ignited. In test no 3 the sample ignited at 679 seconds and extinguished at 1200 seconds.

Gas analysis

The following gas concentrations were measured in the test chamber. The gas samples were taken from the geometrical centre of the test chamber. The concentrations of the different gas species were measured with FTIR gas analysis. The gas concentrations are evaluated after 8 minutes test time and reported as the Conventional Index of Toxicity, CIT, according to prEN 45545-2, section 3.1.4.

Gas species	Measured concentration during flaming exposure, irradiance of 25 kW/m ²					
	Test no 1		Test no 2		Test no 3	
	(mg/m ³)	(g/kg)	(mg/m ³)	(g/kg)	(mg/m ³)	(g/kg)
CO ₂	5742.0	53.3	5473.0	48.5	5726.0	55.2
CO	54.0	0.5	53.0	0.5	66.0	0.6
H ₂	0.0	0.0	0.0	0.0	0.0	0.0
HCl	0.0	0.0	0.0	0.0	0.0	0.0
HBr	0.0	0.0	0.0	0.0	0.0	0.0
HCN	22.9	0.2	23.2	0.2	27.7	0.3
NO	0.0	0.0	0.0	0.0	0.0	0.0
SO ₂	100.0	0.9	101.0	0.9	122.0	1.2
CIT at 8 min	0.07	-	0.07	-	0.09	-



Appendix 2

	Test no 1	Test no 2	Test no 3	Average
Initial weight (g)	55.0	57.5	52.9	<u>55.1</u>
Final weight (g)	47.1	49.6	39.2	<u>45.3</u>
Mass lost (g)	7.9	7.9	16.6	10.8
CIT at 8 min	0.07	0.07	0.09	<u>0.08</u>

Table of sign

D_s Specific optical density, calculated as follows:

$$D_s = 132 \log \frac{100}{T} \quad \text{where } T = \text{percent light transmittance.}$$

$D_{s, \max}$ Maximum specific optical density.

$D_{s, 10}$ Specific optical density at 10 minutes.

D_c Specific optical density correction factor for the smoke absorbed on the glass windows of the optical system.

CIT Conventional Index of Toxicity, calculated as follows:

$$CIT = 0.0805 \sum_{i=1}^{i=3} \frac{c_i}{C_i}$$

where c_i = concentration of the i^{th} gas in the chamber
 C_i = reference concentration of the i^{th} gas.

Measured data

Thickness 7.8 – 8.3 mm.

Area weight 3.0 – 3.5 kg/m².

Conditioning

According to FN 13238, 2000.

Temperature (23 ± 2) °C.

Relative humidity (50 ± 5) %.

Date of test

April 28, 2006.

Test results ISO 5660-1:2002

Product

Carpet called "highline 80/20 1400 wt", consisting of tufted cut pile of 80 % wool and 20 % polyamide and backing of woven textile. The product has a nominal area weight of 2.70 kg.m² and a nominal thickness of 8.7 mm. The colour on the carpet was blue.

Test specification

Irradiance level:	25 kW/m ² .
Calibration constant (C):	0.0416 m ^{1/2} g ^{1/2} K ^{1/2} .
Orientation:	Horizontal.
Backing:	No other than the non-combustible required in the standard.
Fastening:	The specimen was glued to a plywood, having a density of 450 kg.m ³ and nominal thickness of 12 mm approximately, with glue primer "Casco Drag Loss Primer 3443", glue primer amount 85 g.m ² approximately and glue "Casco Proff Solid 3480", glue amount 370 g/m ² approximately.
Note	The retainer frame was used.

Test results

Property	Name of variable	Test 1	Test 2	Test 3	Average value
Flashing (min:s)	t _{flash}	01:46*	-	-	-
Ignition (min:s)	t _{ign}	02:55	01:41	02:05	02:14
All flaming ceased (min:s)	t _{ext}	05:36	-	-	-
Test time (min:s)	t _{test}	20:00	20:00	20:00	20:00
Heat release rate (kW/m ²)	q	See figure 1			
Peak heat release rate (kW/m ²)	q _{max}	8**	149**	128**	95**
Average heat release, 3 min (kW/m ²)	q ₁₈₀	3	9	19	10
Average heat release, 5 min (kW/m ²)	q ₃₀₀	2	13	21	12
Total heat produced (MJ/m ²)	THR	1.1	64.6	63.7	43.2
Sample mass before test (g)	M _i	98.6	100.6	97.3	98.8
Sample mass at sustained flaming (g)	M _s	96.7	-	-	-
Sample mass after test (g)	M _f	77.3	54.1	74.5	68.6
Average mass loss rate (g/m ² s)	MLR _{ign-end}	2.2	-	-	-
Average mass loss rate (g/m ² s)	MLR _(t,90)	2.3	5.3	3.4	3.7
Total mass loss (g/m ²)	TML	2209	5326	2507	3347
Effective heat of combustion (MJ/kg)	ΔH _c	0.5	12.1	25.4	12.7
Volume flow in exhaust duct (l/s)	V	24	24	24	24
Maximum rate of heat emission (kW/m ² s)MARHL	MARHL	2**	54**	53**	36**

*Transitory flaming

**No retests were done despite the 180s mean heat release rate readings differ by more than 10 % from the arithmetic mean.

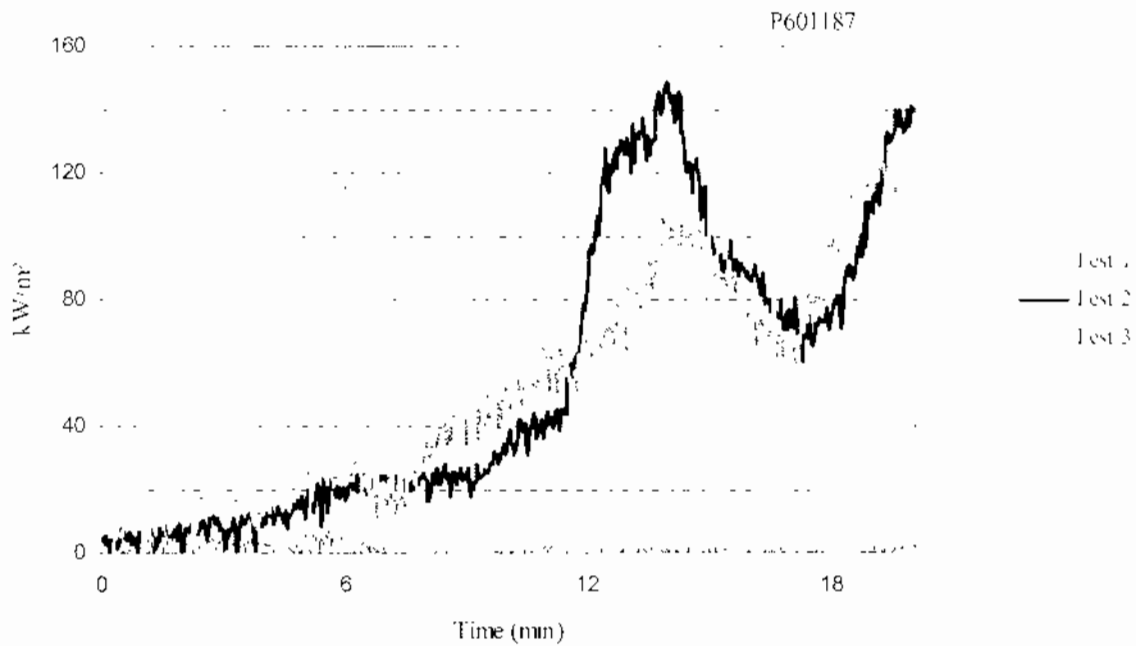
Graphs of heat release rate and smoke production rate

Figure 1 Heat release rate for "highline 80, 20 1400 wt", triplicate tests at an irradiance of 25 kW/m^2 .

Measured data

Thickness 7.8 - 8.3 mm.
Area weight 3.0 - 3.5 kg/m^2 .

Conditioning

According to EN 13238, 2000.

Temperature $(23 \pm 2) ^\circ\text{C}$.
Relative humidity $(50 \pm 5) \%$.

Date of test

April 27, 2006.

Test results explanation – ISO 5660

Parameter	Explanation
Test start	The test specimen is subjected to the irradiance and the clock is started.
t_{flash}	Time from test start until flames with shorter duration than 1 s.
t_{ign}	Time from test start until sustained flaming with duration more than 10 s.
t_{ext}	Time from test start until the flames have died out.
End of test	Defined as the time when both, the product has been extinguished for 2 minutes, and the mass loss is less than 150 g/m ² during 1 minute.
T_{test}	Test time. From test start until end of test.
q_{max}	Peak heat release rate during the entire test.
q_{180}	Average heat release rate during 3 minutes from ignition. If the test is terminated before, the heat release rate is taken as 0 from the end of test.
q_{300}	Average heat release rate during 5 minutes from ignition. If the test is terminated before, the heat release rate is taken as 0 from the end of test.
IHR	Total Heat Released from test start until end of test.
M_0	Mass of specimen.
M_s	Mass of specimen at sustained flaming.
M_f	Mass of specimen at the end of the test.
$MLR_{\text{ign-end}}$	Mass Loss Rate. Average mass loss rate from ignition until end of test.
MLR_{10-90}	Mass Loss Rate. Average mass loss rate between 10% and 90% of mass loss.
TML	Total mass loss from ignition until end of test.
AH_c	Effective heat of combustion calculated as the ratio between total energy released and total mass loss calculated from ignition until end of test.
V	Volume flow rate in exhaust duct. Average during the test.
MARHE	Maximum Rate of Heat Emission.