

TEST REPORT NO. RTE1609/00:E

27 June 2000



T018 (EN 45001)

I006 (EN 45004)

## Determination of the fire properties of a floor covering

### Densiphalt<sup>®</sup> coating

Method:  
NT FIRE 007

Requested by:  
Interasfaltti Oy

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**Requested by** Interasfaltti Oy  
Läntinen Teollisuuskatu 15  
FIN-02920 Espoo, Finland

**Order** 14 April 2000 / Ari Kumpulainen

**Testing laboratory** VTT BUILDING TECHNOLOGY Fire Technology  
P.O.Box 1803 (Street address: Kivimiehentie 4, 02150 Espoo, Finland)  
FIN-02044 VTT, Finland

**Contact person at VTT** Jussi Rautiainen Tel. +358 9 456 4809 Fax +358 9 456 4815

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**Task** **Determination of the fire properties of a floor covering**

**Sample** Date of delivery: 14 April 2000

Name: Densiphalt® coating  
Manufacturer: Interasfaltti Oy

Product data: The product is described in Appendix 2, which contains the RT Card No. RT 536–35754 supplied by the client.

The measured square mass of the sample was about 82 kg/m<sup>2</sup> and the thickness 35 mm.

**Date of the test** 12 May 2000

**Test method** SFS 4195:E (1986), NT FIRE 007 (1985) *Floorings: Fire spread and smoke generation.*  
The description of the method and requirements are presented in Appendix 1.


**Results** The floor covering did not ignite in any of the four tests carried out.

**Summary**


On the basis of the test results, the tested Densiphalt® coating meets the following requirements

- Class L according to the publication "*Fire Safety Approval for Building Products, Environment Guide 35/1998*", clause 3.3, issued by Ministry of the Environment in Finland
- Class G in Norway, Sweden and Denmark according to the product rules given by the Nordic committee for building regulations *Product Rules for Fire Resistant Floor Coverings, NKB Product Rules No 6, July 1988*.

Espoo, 27 June 2000



Jarmo Ruohomäki  
Senior Research Scientist



Jussi Rautiainen  
Building Engineer

**Appendices**

Appendix 1 description of the method and the requirements  
Appendix 2, RT 536-35754

**Distribution**

Client  
VTT/Archive

Original  
Original

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## DESCRIPTION OF THE METHOD

### SFS 4195:E (1986), INSTA 414 *Fire tests. Floorings. Fire spread and smoke generation*

Corresponds to the method NT FIRE 007 *Floorings: Fire spread and smoke generation*

#### Test specimens

Four specimens sized 400 mm × 1000 mm are tested, two in the length and two in the width direction.

According to the end use of the flooring each specimen is fastened either on a silicate board or a particleboard with a density of about 680 kg/m<sup>3</sup> and size of 400 mm × 1000 mm.

Before testing, the specimens shall be conditioned to constant mass at a temperature of 23 ± 2 °C and relative humidity of 50 ± 5%

#### Test procedure

The specimen is mounted at an angle of 30° to the horizontal plane. A burning wooden crib measuring 100 mm x 100 mm and weighing about 40 ± 2 g is placed on the floor covering. Distance from the middle point of the crib to the bottom edge of the specimen is 100 mm. 15 seconds after the placing of the crib forced air flow of 2 m/s is passed over the exposed surface.

During the test, the time at which the floor covering ignites, the time at which the flames die out and the time at which the glowing dies out are recorded. Also the density of smoke is measured during the test. The test is terminated 15 min after the start of the test. Finally the damaged length from the middle point position of the ignition source is measured and possible damages to the underlay are checked.

#### Requirements

Requirements concerning floor coverings have been given in regulations issued by the Ministry of the Environment and in product rules given by the Nordic Committee on Building Regulations. The regulations have been published in the publication "National Building Code of Finland, Part E1, Structural fire safety in buildings, regulations and guidelines 1997". Clause 3.3 in the publication "Fire Safety Approval for Building Products, Environment Guide 35/1998" by the Ministry of the Environment of Finland gives the acceptance criteria for floorings of class L. The Nordic Product Rules have been published in the publication: "Produktregler for Brandmæssigt egnede Gulvbelægninger. NKB Produktregler 6, Juli 1988".


The floor covering is considered to belong to class L, if it in four tests meets the following requirements:

- The average damaged length in the surface layer may not exceed 550 mm measured from the centre of the fire source
- The average damaged length in the underlay may not exceed 550 mm measured from the centre of the fire source
- The maximum damaged length in the floor covering and in the underlay may not for any specimen exceed 800 mm measured from the centre of the fire source.
- The average value of the maximum smoke densities measured during the first five minutes does not exceed the scale value 30 % and after that the scale value 10 %. (Environment Guide 35/1998).
- The average value of the maximum smoke densities measured during the first five minutes does not exceed the scale value 30 %. The smoke density is given in percentages of total non-transparency. (NKB Produktregler 6).
- The average value of the maximum smoke densities measured during the last ten minutes does not exceed the scale value 10 %. (NKB Produktregler 6).

10/99/MK470-E

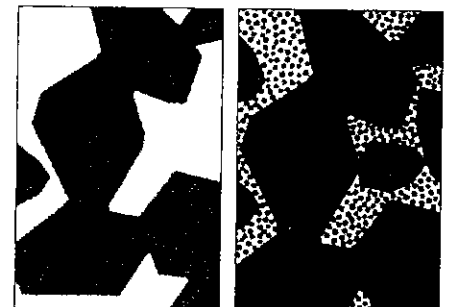
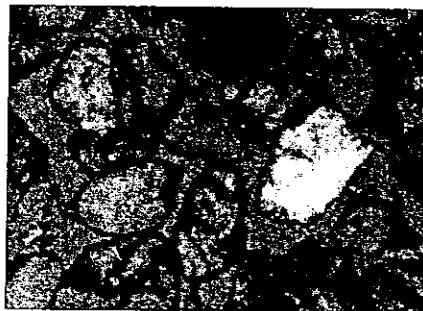
## DENSIPHALT®-PÄÄLLYSTE

Interasfaltti Oy

APPENDIX NO.	2 (11)
REPORT NO.	RTE 1609/00:E
SIGNATURE	<i>[Signature]</i>
 <b>VTT</b> VTT. BUILDING TECHNOLOGY FIRE TECHNOLOGY	



Densiphalt kuuluu puolikovien päälysteiden tuoteryhmään ja siinä yhdistyvät asfaltin ja betonin parhaat ominaisuudet: asfaltin joustavuus ja saumattomuus sekä betonin suuri kuormitettavuus ja kulutuksenkestävyys.



Tavallinen sideaine

Mikrosiliikka sisältävä Densit-sideaine

### OMINAISUUKSIA

Densiphalt on kehitetty aikaisempien komposiittipäälysteiden pohjalta. Erityisen, juoksevan Densit-laastin ansiosta Densiphalt osoittautuu usein edulliseksi päälysteratkaisuksi.

Densiphalt-päälysteellä on hyvät lujuus-, tiiviys- ja työstettävyysominaisuudet.

Joustavuus ja saumattomuus saavutetaan korkean bitumipitoisuuden ansiosta jokaisen kiviaineskappaleen ympärille muodostuvan paksun bitumikalvon avulla. Densiphalt-laastin korkea laatu ja hyvät käsittelyominaisuudet varmistavat hyvän kantokyvyn ja kulutuksenkestävyyden.

Laastin hyvän tiiviyn ansiosta Densiphaltin pakkasen ja sulamisen kestävyys ovat hyvät ja pinta kestää vastavantyyppisiin pintakerroksiin verrattuna huomattavasti paremmin tiesuolan, öljyn ja kemikaalien vaikutuksia.

### PINTAKERROKSEN PERIAATE

Densiphalt muodostuu avoimesta asfaltista, jonka huokospitoisuus on korkea (25...28 %), ja kiviainesrakeita ympäröivästä paksusta bitumikalvosta. Avoimen asfaltin huokokset täytetään lujualla Densiphalt-laastilla, joka täyttää asfaltin tyhjätilan tehokkaasti.

### KÄYTTÖKOHTEET

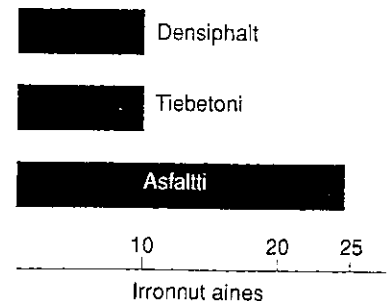
Densiphaltia voidaan käyttää niin uudisrakentamisessa kuin kunnostustöissäkin. Densiphaltin tyypillisiä käyttökohteita ovat:

- teollisuuslattiat
- varastot, tuotantotilat
- satamat
- tiet, risteysalueet
- linja-autotermiinalit
- raskaasti liikennöidyt pysäköintialueet
- rampit
- lentokentät
- rahtiasemat

### DENSIT-SIDEAINE

Densiphaltin sideaineella Densitillä on ominaisuuksia, joita ei ole aikaisemmin ollut millään muulla sementtipohjaisella tuotteella. Nämä ominaisuudet saavutetaan patentoidulla mikrosiliikalla parannetulla sementtisisidosaineella, jonka mikrorakenne on hyvin tiheä. Densiphalt-laasti sisältää hiukkasia, joiden koko on vain sadasosa sementtahiukkasen kosta. Erikoisteknologian ansiosta sementtahiukkasten väliset huokokset täyttyvät näillä hienojakoisilla hiukkasilla, jolloin saavutetaan 80 % teoreettisesta täyttöasteesta. Tavallisella sementtillaastilla päästään 40...50 % täyttöasteeseen.

### Kulutuksenkestävyys



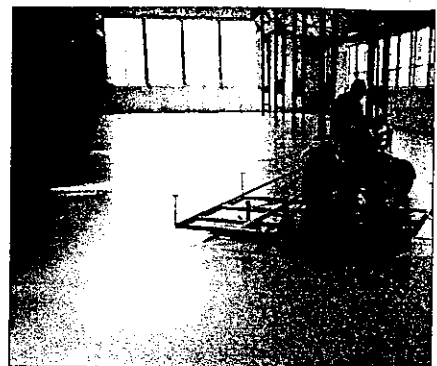
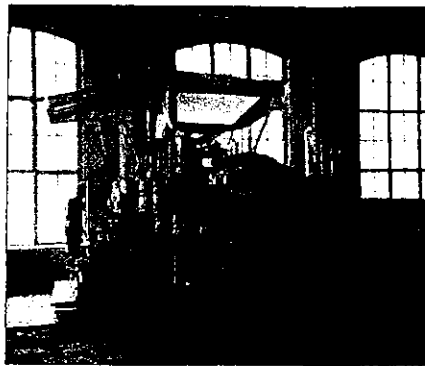
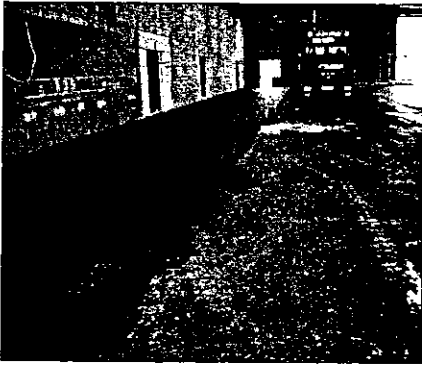
Lähde: Veisliter'n, Norja

*Nastarenkailla ajon liikennesimulaatio on osoittanut, että Densiphaltin kulutuksenkestävyys on yhtä hyvä tai jopa parempi kuin parhailla tieteboneilla (9,7 SPS). Densiphaltin kulutuksenkestävyys (Böhme) on DIN 52 108 -normin mukaan mitattuna 6 cm<sup>3</sup>/50 cm<sup>2</sup>.*

### PÄÄLLYSTEIDEN VERTAILUA

Tuote/Päälystetyyppi	Edut	Haitat
Joustavat (bitumipohjaiset)	Joustava, saumaton, nopea huolttaa	Heikko lujuus, olematon tai rajoitettu staattinen kantokyky, tumma väri
Kovat päälysteet (betoni)	Lujuus, vaalea väri, hyvä kantokyky	Hitaasti kovettuva, saumat, halkeamat, paksut kerrokset
Densiphalt (puolikovat päälysteet)	Asfalttiin verrattuna hyvä kantokyky, joustava, saumaton, nopea huolttaa, vaalea väri	Kaksi työvaihetta, betoniin verrattuna rajoitettu kantokyky

## DENSIPHALTIN LEVITTÄMINEN

**Pohjakerros**

Densiphalt voidaan levittää kantavalle pohjalle, joka on asfalttia, maabetonia tai terästä. Korjaustöissä on kaikki reiät, halkeamat, saumat ja epätasaisuudet ta-  
soitettava ennen avoimen asfaltin levittä-  
mistä

**Avoin asfaltti**

Avoin asfaltti levitetään tavallisella as-  
falttikoneella 30...60 mm paksuisena  
kerroksena. Asfaltti tiivistetään valssi-  
räällä.

**Densiphalt-laasti**

Vaalea juokseva Densiphalt-laasti pum-  
pataan asfaltille ja levitetään kumilastoil-  
la. Kun Densiphalt-laasti on tunkeutunut  
läpikotaisin asfalttikerrokseen, laastin le-  
vitystyö on valmis. Tämän jälkeen pinnal-  
le voidaan tehdä tarvittaessa käyttötarkoi-  
tukseen soveltuva, esim. kitkaa lisäävä tai  
ulkonäköä parantava viimeistely.

Densiphalt  
3...6 cm

Tasausasfaltti  
0...2 cm

Betoni  
väh. 10 cm

Asfaltti  
n. 6...25 cm.

**TEKNISET TIEDOT**

Dynaaminen E-moduuli 20°	8000 MPa
Tyypillinen staattinen kuormitus (alustasta riippuen)	8...10 MPa
Sähkönjohtamisominaisuus	DIN 51953:n mukainen läpikulkuvastusarvot asettuvat alueelle 10° ohmia, ts. ei staattista sähköä
Vierintävastus %:ina kokonaiskuormituksesta	1,8 % työstämättömällä pinnalla
Kitka	kuten asfaltilla, n. 50 SRT
Pakkasen ja roudan kestävyys	Ruotsin standardin nro 137244 mukaan erinomainen
Vastustuskyky	kestää mineraaliöljytuotteita, mietoja happopitoisuuksia ja suoloja
Pöly	pölyn sidonta ei ole välttämätön
Kuiva lattia voidaan tarvittaessa pinnoittaa	5 vrk lämpötilassa 10...15 °C suhteellinen kosteus 80...90 %

## VALMISTUS, MYYNTI JA ASENNUS

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## Reaction to fire classification report of Densiphalt pavement

Classification standard: EN 13501-1:2002



The standards referred to in this report are accredited.

Requested by: NCC Road Oy

**Requested by** NCC Roads Oy  
 Läntinen teollisuuskatu 15  
 FI-02920 Espoo

**Order** 17 June 2007 / Jouko Itkonen

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**1 Task** **Reaction to fire classification report of product Densiphalt pavement**

**2 Introduction** This classification report defines the classification assigned to **Densiphalt pavement** in accordance with the procedures given in EN 13501-1:2002.

**3 Details of classified product**

**3.1 Nature and end use application**

The product **Densiphalt pavement** is defined as composite pavement. This classification is valid for the end use application as pavement.

**3.2 Description**

Product description: **Densiphalt pavement**

Manufacturer: NCC Roads Oy

Product description: Combination of open asphalt, empty space 25...30 %, and Densiphalt plaster which fills the empty space of open asphalt

Composition of open asphalt:

Size of rock material: 5...8 or 8...11

Amount of bitumen: 4,0 %

Amount of fibre: 1,3 %

Chalky filler: 4,2 %

Densiphalt plaster:

Manufacturer: Densit a/s Aalborg, Denmark

Composition: cement based high strength plaster, contains among others microsilicates

**4 Test reports and test results in support of classification**

**4.1 Test reports**

Name of laboratory	Name of customer	Test report ref. no	Test method
VTT	NCC Road Oy	VTT-S-5936-07/GB	EN ISO 9239-1
VTT	NCC Road Oy	VTT-S-6279-07/GB	EN ISO 1716



#### 4.2 Test results

Test method	Parameter	Number of tests	Continuous parameter mean (m)	Compliance parameters
EN ISO 9239-1	Critical flux (kW/m <sup>2</sup> )	3	≥ 11	-
	Smoke (% min)	3	4,6	-
EN ISO 1716	PCS (MJ/kg)	3	1,0	-

### 5 Classification and field of application

#### 5.1 Reference of classification

This classification has been carried out in accordance with clause 11.7 of EN 13501-1:2002.

#### 5.2 Classification

The product **Densiphalt pavement** in relation to its reaction to fire behaviour is classified:

A2<sub>f</sub>

The additional classification in relation to smoke production is:

s1

#### 5.3 Field of application

This classification is valid for the end use applications where the substrate is of class A1<sub>f</sub> or A2<sub>f</sub>.

This classification is valid for all product thicknesses.

### 6 Limitations

#### 6.1 Restrictions

This classification report is valid as long as the composition and structure of the product is same.

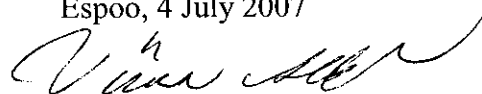
#### 6.2 Warning

This classification report does not represent type approval or certification of the products.

#### Note

This is an English version of the original Finnish classification report with the same report number.

Espoo, 4 July 2007



Tiina Ala-Outinen  
Service Manager



Tiia Ryyänen  
Senior Research Scientist

#### DISTRIBUTION

Customer Original (2)  
VTT / Register Office Original



# Determination of the heat of combustion of Densiphalt pavement according to EN ISO 1716:2002



The test method referred to in this test report is accredited.

Requested by: NCC Roads Oy



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**Requested by** NCC Roads Oy  
Läntinen teollisuuskatu 15  
FI-02920 Espoo

**Order** 17 June 2007 / Jouko Itkonen

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**Assignment** **Determination of the heat of combustion of a pavement**

**Product** The customer gave following information about the product tested:

**Product: Densiphalt pavement**  
**Manufacturer: NCC Roads Oy**  
**Product description: Combination of open asphalt, empty space 25...30 %, and Densiphalt plaster which fills the empty space of open asphalt**  
**Composition of open asphalt:**  
Size of rock material: 5...8 or 8...11  
Amount of bitumen: 4,0 %  
Amount of fibre: 1,3 %  
Chalky filler: 4,2 %  
**Densiphalt plaster:**  
Manufacturer: Densit a/s Aalborg, Denmark  
Composition: cement based high strength plaster, contains among others microsilicates

**Sample** The sample of the product was chosen by the customer.

Date of delivery: 26 June 2007  
Type of sample: two specimens of the product  
Size of specimens: diameter 45 mm and height 55 mm (measured by VTT)  
Density of sample: about 2300 kg/m<sup>3</sup> (measured by VTT)

**Test method** EN ISO 1716:2002 *Reaction to fire test for building products - Determination of the heat of combustion (ISO 1716:2002).*

A description of the method is presented in Appendix 1.

The test specimens were made by grinding the sample to small pieces.

The test results relate only to the sample tested.

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**Date of test** 3 July 2007

**Test results** The test results are shown in Table 1.

The measured water equivalent of the calorimeter was 10,0478 MJ/K.

*Table 1. Measured gross heat of combustion values (PCS) of the product*

Specimen	PCS, MJ/kg
1	1,06
2	1,07
3	0,90
<b>Mean</b>	<b>1,0</b>

**Note** The test results relate 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.

**Note** This is an English version of the original Finnish test report with the same report number.

Espoo, 4 July 2007



Tiia Ryyänen  
Senior Research Scientist



Tuula Ylä-Sulkava  
Senior Research Assistant

**APPENDICES** Appendix 1, Method description

**DISTRIBUTION** Customer Original (2)  
VTT/Register Office Original

## DESCRIPTION OF THE METHOD

**EN ISO 1716:2002**, *Reaction to fire tests for building products - Determination of the heat of combustion (ISO 1716: 2002)*

### Definitions

*Heat of combustion*: Thermal energy produced by combustion of unit mass of a given substance.

*Gross heat of combustion (PCS)*: Heat of combustion of a substance when the combustion is complete and any produced water is entirely condensed under specified conditions.

### Specimens

The specimen is prepared by mixing 0,5 g finely ground sample and 0,5 g benzoic acid into homogenous mixture. For some materials in order to obtain complete combustion it may be necessary to increase or decrease the amount of benzoic acid.

### Test procedure

The specimen is ignited inside a bomb (a closed steel cylinder) in pressurized oxygen atmosphere. The calorimeter measures the temperature rise of the surrounding water and calculates the gross heat of combustion according to the following formula:

$$PCS = \frac{E(T_m - T_i + c) - b}{m}, \text{ where}$$

PCS= gross heat of combustion in (MJ/kg),

$T_i$  = initial temperature in K,

$T_m$  = maximum temperature in K,

E = water equivalent of the calorimeter, the bomb and their accessories, expressed in (MJ/kg),

m = mass of the test specimen in kg,

b = correction in MJ required for the combustion heat of the "fuels" used during the test; i.e.: firing wire, cigarette paper and benzoic acid or combustion aid and

c = temperature correction in K required for the exchange of heat with outside.

### Calibration procedure

The water equivalent E (MJ/K) of the calorimeter, the bomb and their accessories shall be determined by making at least five determinations of the gross heat of combustion of certified benzoic acid.

### Validity of test results

The test results shall comply with the following criteria in the specified range of values:

Difference between maximum and minimum of the three replicated tests

≤ 0,2 MJ/kg (range of validity from 0 MJ/kg to 3,2 MJ/kg)

≤ 0,1 MJ/m<sup>2</sup> (range of validity from 0 MJ/m<sup>2</sup> to 4,1 MJ/m<sup>2</sup>) – only for non-substantial components