



Institut für  
textile Bau- und  
Umwelttechnik  
GmbH

Gutenbergstr. 29  
48268 Greven  
Germany

## Test Report No. 1.1 / 16806 / 0108.0.1-2008e

### General

Issued : 11 April 2008

Order by : **Gutta Werke S.p.a.**  
via delle industrie, 4  
24040 Filago (BG), ITALY

Material : HDPE dimpled membrane (black)  
**GUTTABETA STAR 320 kN**  
(declaration by customer)

Order date : 01 February 2008

Samples delivered : 01 February 2008

| Tests                                      | Standard   | Issue   | Results as<br>Enclosure No. |
|--|------------|---------|-----------------------------|
| 1. Determination of compressive properties | EN ISO 604 | 12.2003 | A1 - A2                     |
| 2. Compressive creep                       | EN 1897    | 02.2002 | A3                          |

The results apply exclusively to the specimens submitted.  
The date of testing is reported on the enclosed enclosure/-es.  
Results are reported to the accuracy given in the standards. In statistical evaluation, the measured accuracy is taken.

This test report contains 2 pages and 3 enclosure/-es (enclosure/-es A1 - A3)  
It may not be published in parts. Only the summary of results may be published as  
"Extract of Test Report No. 1.1/16806/0108.0.1-2008e".

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**Summary of results Test Report No. 1.1 / 16806 / 0108.0.1-2008e**

Date / Ref. : 11 April 2008 / rr  
 Order by : Gutta Werke S.p.a. , via delle industrie, 4 , 24040 Filago (BG), ITALY  
 Material : HDPE dimpled membrane (black)  
**GUTTABETA STAR 320 kN**  
 (declaration by customer)

| Test   | Standard                  | Unit | Mean $\bar{x}$ | Standard-deviation s | Coef. of variation v in % |
|--|---------------------------|------|----------------|----------------------|---------------------------|
| <b>Determination of compressive properties</b> | <b>EN ISO 604 12.2003</b> |      |                |                      |                           |
| compressive stress at yield                    |                           | MPa  | 0,20           | 0,022                | 10,9                      |
| compressive strain                             |                           | %    | 17,3           | 1,49                 | 8,7                       |
| E-Modulus (0,05% - 0,25%)                      |                           | MPa  | 0,36           | 0,098                | 27,3                      |
| <b>Compressive creep</b>                       | <b>EN 1897 02.2002</b>    |      |                |                      |                           |
| Normal stress 5,0 kPa                          |                           |      |                |                      |                           |
| Shear stress -                                 |                           |      |                |                      |                           |
| Thickness after 1 h stress                     |                           | mm   | 6,51           | -                    | -                         |
| Thickness after 1000 h stress                  |                           | mm   | 6,44           | -                    | -                         |

Prof. Dr.-Ing. Müller-Rochholz

i.A. Raskob  
 Dipl.-Ing. (FH) Raskob

# Determination of compressive properties EN ISO 604 (12.2003)

Test Report No. : 1.1/16806/0108.0.1-2008  
 Company : GUTTA  
 Operator : tb  
 Date : 18.02.2008  
 Material : GUTTABETA STAR 320 KN

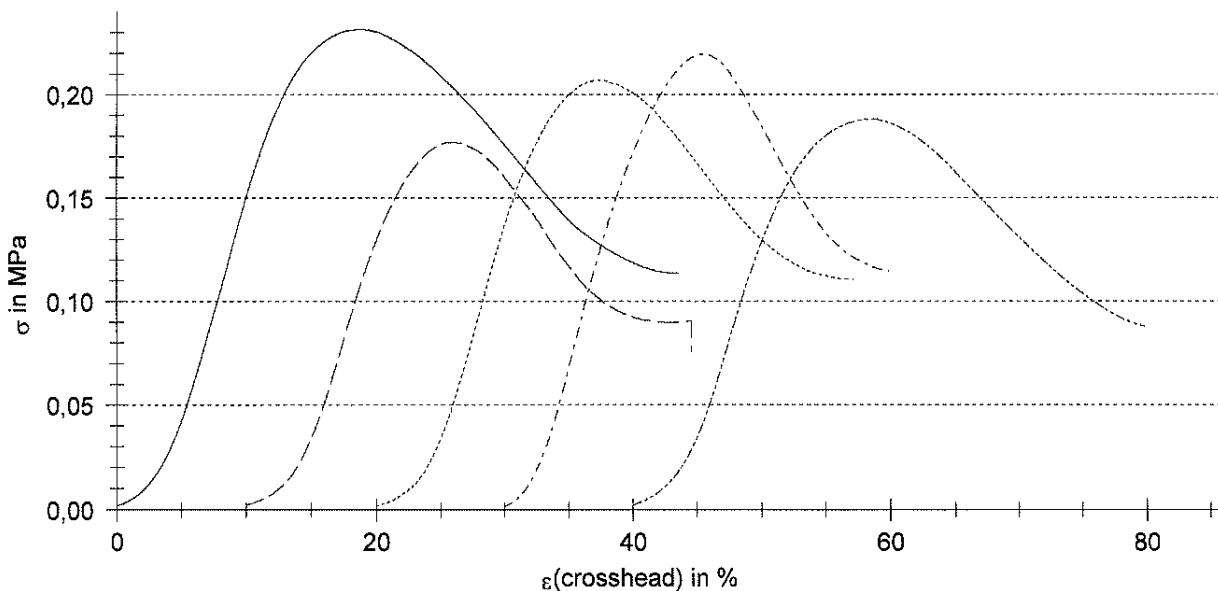
## Test parameters

Climate : 21°C / 48% rel. humidity      b0 : 92,32 mm  
 Machine : Zwick - Z030                      a0 : 92,48 mm  
 Load cell : 2,5 kN                              Dimple/m<sup>2</sup> : 1875  
 Wegaufnehmer: Crosshead                      Dimple/Sample: 4 x 4  
 Pressure plate : 120mm x 120mm              Pre-load : 18 N

## Results

| Nr | A<br>cm <sup>2</sup> | $\sigma_y$<br>MPa | $\varepsilon-\sigma_y$<br>% |
|----|----------------------|-------------------|-----------------------------|
| 1  | 85,38                | 0,231             | 18,86                       |
| 2  | 85,38                | 0,177             | 15,81                       |
| 3  | 85,38                | 0,207             | 17,38                       |
| 4  | 85,38                | 0,219             | 15,66                       |
| 5  | 85,38                | 0,188             | 18,56                       |

## Series graphics



## Statistics

| Serie<br>n = 5 | A<br>cm <sup>2</sup> | $\sigma_y$<br>MPa | $\varepsilon-\sigma_y$<br>% |
|----------------|----------------------|-------------------|-----------------------------|
| $\bar{x}$      | 85,38                | 0,204             | 17,25                       |
| s              | 0,000                | 0,022             | 1,49                        |
| v              | 0,00                 | 10,90             | 8,66                        |

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# Determination of compressive properties EN ISO 604 (12.2003)

Test Report No. : 1.1/16806/0108.0.1-2008  
 Company : GUTTA  
 Operator : tb  
 Date : 19.02.2008  
 Material : GUTTABETA STAR 320 KN

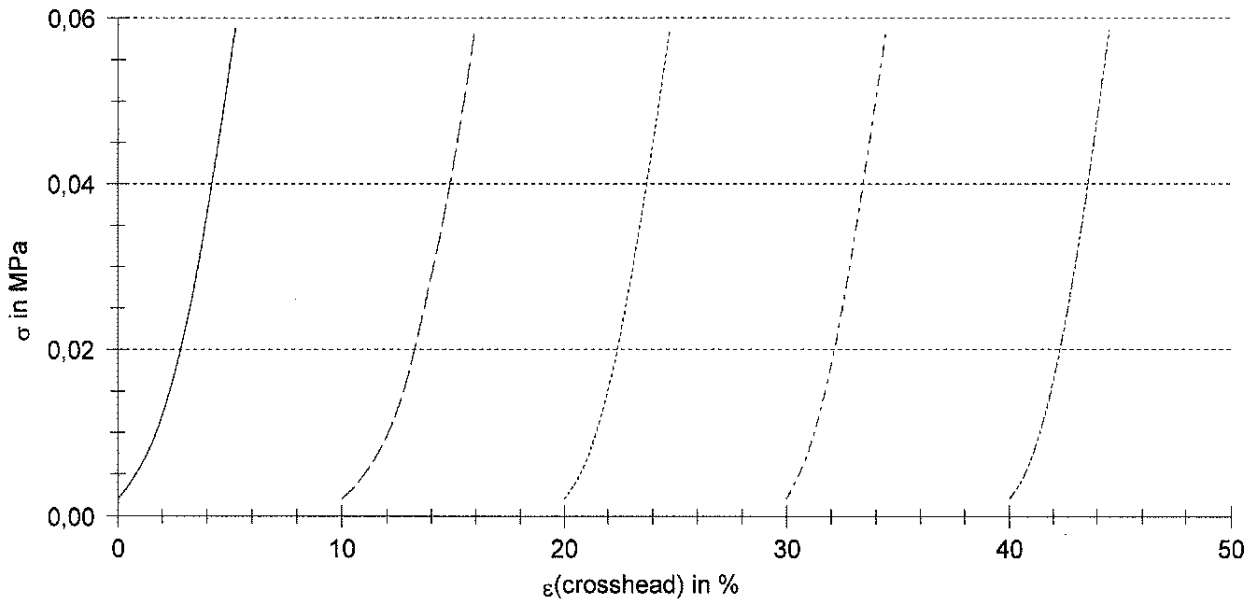
## Test parameters

Climate : 21°C / 48% rel. humidity      b0 : 92,32 mm  
 Machine : Zwick - Z030                      a0 : 92,48 mm  
 Load cell : 2,5 kN                              Dimple/m<sup>2</sup> : 1875  
 Wegaufnehmer: Crosshead                      Dimple/Sample : 4 x 4  
 Pressure plate : 120mm x 120mm              Pre-load : 18 N

## Results

| Nr | A<br>cm <sup>2</sup> | EMod (0,05% - 0,5%)<br>MPa |
|----|----------------------|----------------------------|
| 1  | 85,38                | 0,290                      |
| 2  | 85,38                | 0,255                      |
| 3  | 85,38                | 0,365                      |
| 4  | 85,38                | 0,509                      |
| 5  | 85,38                | 0,368                      |

## Series graphics



## Statistics

| Serie<br>n = 5 | A<br>cm <sup>2</sup> | EMod (0,05% - 0,5%)<br>MPa |
|----------------|----------------------|----------------------------|
| x              | 85,38                | 0,357                      |
| s              | 0,000                | 0,098                      |
| v              | 0,00                 | 27,33                      |

Remark: -

**Determination of the compressive creep properties  
EN 1897 (02.2002)**

Test report No. : 1.1/16806/0108.0.1-2008  
 Company : Gutta Werke Spa  
 Material : GUTTABETA STAR 320 KN  
 Operator : br  
 Date: 1.4.2008

**Test parameters**

Normal stress : 5,0 kPa  
 Shear stress : -  
 Shear direction : -  
 MD - machine direction, CMD - cross machine direction  
 Specimen size : (185 x 185) mm  
 Thickness at 2 kPa : 6,61 mm  
 Temperature : 20°C ± 2°C  
 Note : Specimen with 64 nobs

**Results**

| Time               | h  | 0,017 | 0,033 | 0,07 | 0,13 | 0,3  | 0,5  | 1    | 2    | 4    | 24   | 48   | 72   | 96   | 144  | 188  | 336  | 672  | 1000 |      |
|--------------------|----|-------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Thickness          | mm | 6,54  | 6,53  | 6,53 | 6,52 | 6,51 | 6,51 | 6,50 | 6,50 | 6,49 | 6,48 | 6,47 | 6,47 | 6,47 | 6,47 | 6,46 | 6,45 | 6,44 | 6,44 | 6,44 |
| Compressive strain | %  | 100,0 | 99,8  | 99,8 | 99,7 | 99,6 | 99,5 | 99,4 | 99,3 | 99,2 | 99,1 | 98,9 | 98,9 | 98,9 | 98,9 | 98,8 | 98,6 | 98,5 | 98,5 | 98,5 |

