



BG Millag ApS  
Egegårdsvej 5  
DK-5260 Odense S

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fgu-fhgs/eta

### **Approval of products according to DS/INF 466 - JUNIFOL PELLD SL**

Assessment and examination of the below products for the purpose of approval according to DS/INF 466, 1<sup>st</sup> edition 1999-08-16, Sanitary landfill liners.

Welded samples and liner samples have been received here on 26 February 2015.

According to the client, the liner type JUNIFOL PELLD SL has been manufactured in co-operation with JUTA and Millag ApS.

The following two products have been assessed and examined:

- JUNIFOL PELLD SL, 1.0 mm
- JUNIFOL PELLD SL, 1.5 mm

### **Testing of liner and weldings**

In order to assess the liners according to DS/INF 466, 1<sup>st</sup> edition 1999-08-16, Sanitary landfill liners and related data sheet for JUNIFOL PELLD SL, we have carried out the following supplementary measurements:

1. testing of the weld seam strength of 1.0 and 1.5 mm liners with welding
2. Tear resistance according to ISO 6383/1
3. Puncture resistance according to FTMS No.101 C Method 2031 (1980)
4. Visual assessment of the liner

### **Summary**

Based on an evaluation/assessment of the data sheet and testing of welded samples delivered by Millag ApS, the following 2 liners:

- JUNIFOL PELLD SL, 1.0 mm
- JUNIFOL PELLD SL, 1.5 mm

fulfil the requirements in DS/INF 466, 1<sup>st</sup> edition 1999-08-16, point 3.4.1.

Liner properties according to DS/INF 466, 1<sup>st</sup> edition 1999-08-16, Sanitary landfill liners, point 3.4.1 and data sheet for JUNIFOL PELLD SL (24.02.2015) from the manufacturer of the liners, JUTA, and the weldings from Millag ApS.

Values from the data sheet are written in normal types. Additional values, which have been determined by DTI/Centre for Plastics Technology, are in italics.

JUNIFOL PELLD SL				
Sanitary landfill liners			Sample ID	
Property	Test method according to DS/INF 466	Requirement according to DS/INF 466	PELLD, SL 1.0	PELLD, SL 1.5
Appearance	Visual assessment	No visible defects	<i>Ok</i>	<i>Ok</i>
Thickness	ISO 4648 (1991)	Deviation from nominal thickness max -10 %	<i>1.0 mm</i>	<i>1.5 mm</i>
Tensile properties	ISO 527-3 (1993)	Elongation at break (MD/TD) > 50 % Ultimate stress (MD/TD) > 10 MPa Elongation at yield (MD/TD), % Yield stress (MD/TD), MPa	<i>516/798</i> <i>25/31</i> <i>16/16</i> <i>13/13</i>	<i>778/786</i> <i>31/31</i> <i>12/11</i> <i>13/13</i>
Tear resistance	DS/ISO 6383/1 (1985)	75 N/mm	<i>&gt;240 N/mm</i>	<i>&gt; 250 N/mm</i>
Puncture resistance	FTMS No. 101 C Method 2031 (1980)	>300 N	<i>&gt;700 N</i>	<i>&gt;900 N</i>
Weld seam strength, peeling	ISO 527-3 (1993)	>75 % of ultimate strength or yield strength	<i>Requirement fulfilled, &gt; 75 % of yield strength</i>	
Friction properties	ISO 8295 (1995)	No requirements	Dependent on the foundation	
Dimensional change in heat	DIN 16938 (1986)	<± 2 %	<i>≤2 % according to EN 1107-2, assessed to be OK</i>	
Cold resistance	ISO 974 (1980)	Brittleness temperature <- 20 °C	<i>&lt; -20 °C</i>	
Weather resistance	ISO 6964 (1986)	Carbon black > 2 %	<i>2-3 %</i>	<i>2-3 %</i>
Chemical resistance	ISO 178 (1981) ISO 1817 (1985) PrEn 1847	Change in weld seam strength and tensile properties max 20 % after immersion for 16 weeks at 23 °C	According to our experience, the described exposure with artificial leachate does not influence on good quality PELLD	
Biological resistance	DIN 53739 (1984)	Change in weld seam strength max 20 % after burial for 16 weeks	According to our experience, the described exposure according to DIN 53379 does not influence on PELLD or its welding	

Yours sincerely  
Centre for Plastics Technology



Flemming Gudbergsen  
Laboratory Technician

Phone: +45 72 20 31 24 (direct)  
E-mail: fgu@dti.dk

The testing has been performed on the enclosed General Terms and Conditions regarding Commissioned Work accepted by the Danish Technological Institute

# General Terms and Conditions regarding Commissioned Work Accepted by the Danish Technological Institute\*

## General stipulations

These General Terms and Conditions shall apply to all commissioned work performed by the Danish Technological Institute ("the Institute") for a contract party (the "customer"), including, but not limited to, counselling, instruction, information retrieval and communication, testing, research, sale and leasing. Unless otherwise agreed, these General Terms and Conditions shall also apply to any other and subsequent agreements between the Institute and the customer. Unless specifically accepted in writing by the Institute, any deviating provisions or provisions to the contrary contained in the order placed by the customer or in his acceptance shall not apply.

However, the Institute's "General Terms and Conditions regarding Certification, Inspection or Approval Bodies Associated with the Danish Technological Institute" shall apply to commissioned work relating to certification, inspection or approval schemes.

## 1. Scope of commissioned work

- 1.1 The nature, contents and financial conditions of the commissioned work shall be stated in a written agreement. Any amendments to the agreement shall be in writing.
- 1.2 Time schedules, price estimates, etc. are approximate unless otherwise agreed in writing. If the Institute foresees major delays or budget overruns compared to the agreed terms or material obstacles to the performance of the commissioned work, the customer shall be informed thereof, following which he shall be entitled to change or stop the work, cf. clause 6.1.
- 1.3 The Institute shall be entitled to a fee for work performed regardless of whether the results expected by the customer are achieved, unless it has been agreed in writing between the parties that the Institute's fee is contingent upon the achievement of concrete, specified results.
- 1.4 The Institute shall be entitled to have commissioned work performed by a sub-contractor.

## 2. Professional discretion

- 2.1 The Institute will observe customary professional discretion with respect to disclosure of the performance of commissioned work and with respect to any agreements. A special agreement in writing shall be concluded if the customer requires secrecy as such, for example regarding know-how of the customer that may come to the knowledge of the Institute during the performance of commissioned work.
- 2.2 If any test or development work leads to results of interest to the general public, the Institute may publicly announce such results unless otherwise agreed in a secrecy agreement as mentioned under clause 2.1.
- 2.3 When the Institute undertakes work that involves an assessment of a service provided by a third party, the customer accepts and understands that the Institute may approach such third party and other relevant bodies in order to obtain information for use in performing the work.
- 2.4 The Institute shall at any time be entitled to pass on information, which the Institute is under a statutory obligation to disclose.
- 2.5 If, in the course of performing commissioned work, the Institute becomes aware of factors that in the opinion of the Institute may cause material damage to health or environment, the Institute may, if required, inform the customer thereof. In the event that the customer does not, as quickly as possible, take the steps necessary to prevent or limit the risk of material damage to health or environment, the Institute shall, notwithstanding any separate agreement on discretion or secrecy, be entitled to pass on such knowledge to the relevant authorities.

## 3. Reference to results, etc.

- 3.1 The customer may only publish the reports of the Institute in their entirety.
- 3.2 The customer may not mention or refer to the Institute or the Institute's employees for advertising or marketing purposes unless the Institute has granted its written consent in each case. Such consent shall lapse if the customer stops or postpones the work, cf. clause 6.1.
- 3.3 Course material issued by the Institute may not be copied or duplicated. Course material on loan from the Institute shall remain the property of the Institute.
- 3.4 The Institute shall be entitled to demand that the customer returns reports, etc. prepared by the Institute together with the pertinent documents if the Institute discovers any errors or defects in such material.

## 4. Rights relating to the results of the commissioned work

- 4.1 The tangible material produced by the Institute in connection with commissioned work and the right to utilise such material, shall be the property of the customer.
- 4.2 Know-how and other intangible property rights developed by the Institute or ascertained by the Institute in connection with performing the work shall be the exclusive property of the Institute.

## 5. Fees and terms of payment

- 5.1 Commissioned work shall be performed according to account rendered based on the hourly rates from time to time fixed by the Institute plus transport charges and other outlays.
- 5.2 In respect of long-term work, the Institute shall be entitled regularly to adjust the hourly rates stated under 5.1. The customer shall receive notice of such adjustments 30 days prior to the date on which they come into force.

- 5.3 The Institute shall be entitled to issue invoices on account once a month for work performed in the past month.
- 5.4 In case of overdue payment of balances due to the Institute, interest shall be charged at the rate of 1.5% for each commenced period of one month.

## 6. The right to change and cancel orders

- 6.1 If the customer issues instructions to stop or postpone the work, cf. clause 1.2, work already performed shall be paid for according to invoice, just as the customer shall reimburse the Institute for any costs incurred in connection with the cancelled or postponed work that the Institute has already undertaken to pay, such as expenses to a third party, special equipment or premises, etc.
- 6.2 Moreover, the nature or scope of commissioned work may only be changed subject to the written consent of the Institute.

## 7. Liability

- 7.1 The Institute shall be liable towards the customer for any errors and negligence in connection with the performance of the work pursuant to the general rules of compensation of Danish law, subject to such limitations as follow from clauses 7.2 to 7.12. The Institute shall in no event be liable for circumstances or events causing a loss that are not attributable to any errors or negligence on the part of the Institute.
- 7.2 If the performance of commissioned work is stopped or postponed (cf. clause 6), the Institute shall not be liable for any defects or errors in work already performed.
- 7.3 The Institute shall not be liable for injury or damage arising in connection with the use of counselling provided by the Institute or test or control reports prepared by the Institute if the use thereof is outside the scope of the commissioned work or the specified objects.
- 7.4 If the Institute's work is not concluded with a report or the delivery of a service, or if the service provided consists of a statement in which it is specified that it is based on an estimate or assessment, the Institute shall not be held liable unless the Institute is guilty of gross negligence.
- 7.5 Unless the Institute has issued a written warranty for the completion of the work at a specific time, the Institute shall not accept liability for loss or damage caused by delays in the performance of commissioned work.
- 7.6 The Institute shall not be held liable for tortious acts on the part of any one of the Institute's sub-contractors, unless such sub-contractor has been appointed by the Institute without being proposed or approved by the customer.
- 7.7 In case of joint liability between the Institute and one or more parties, the Institute shall only accept liability for such proportion of the loss suffered by the customer as is accounted for by the share of the overall liability attributable to the Institute.
- 7.8 If the Institute has undertaken, on behalf of the customer, to verify that services provided by a third party to the customer are according to contract, the Institute shall only be held liable for loss or damage that the customer might suffer owing to the Institute's failure to point out, in due time, that a specific service is not according to contract. Thus, the Institute's liability shall be subordinated to the claim for compensation that the customer may make against the third party in question, and the Institute's liability shall moreover be subject to the other limitations stated in this clause 7.
- 7.9 If the Institute has received samples or equipment from the customer, the Institute shall exclusively be held liable for loss of or damage to such samples or equipment if an agreement in writing has been made with the customer to return such samples and equipment. In addition, in such event, the Institute shall only be held liable if it can be substantiated that the Institute is guilty of gross negligence, and the compensation can in no event exceed the cost of the material necessary for manufacturing the samples or equipment in question. If the return of samples and equipment has not been agreed upon, the Institute will only keep such samples and equipment for a period of up to six months after the completion of the work.
- 7.10 The Institute cannot be held liable for more than the direct loss suffered by the customer. Thus, the Institute shall not be held liable for losses on operations, loss of earnings or any other indirect losses. The Institute's total liability shall not exceed DKK 1,000,000 for each individual claim except for bodily injury according to Danish law.
- 7.11 If any third party holds the Institute liable for bodily injury or damage to property caused by work performed by the Institute, including, but not limited to, product liability, the customer shall be obliged to indemnify and hold the Institute harmless from any claim exceeding the amount of any claim(s) that can be brought against the Institute pursuant to the provisions of this clause 7. The Institute may request the customer to defend any such claim on behalf of the Institute.
- 7.12 The Institute cannot be held liable for claims regarding loss, damage or injury that have not been made in writing within three years after delivery by the Institute of the service in respect of which the claim is made. In addition, the Institute's liability is contingent upon the customer complaining in writing as soon as he has become aware of, or should have become aware of, the existence of a potential claim for compensation against the Institute. Notwithstanding the said time limit of three years, the Institute shall not be liable for any damage or injury that was impossible to foresee in view of the know-how and technology available at the time of the performance of the commissioned work.

7.13 If the Institute is prevented from performing its obligations under the agreement as a result of extraordinary external factors which should not have been foreseen by the Institute at the time when the agreement was concluded (force majeure), this will not be deemed to constitute breach.

**8. Disputes**

8.1 Any dispute or controversy arising between the Institute and the customer shall be settled according to Danish law by the Court in Glostrup, Denmark, however, if the case is within the jurisdiction of the Danish Maritime and Commercial Court, the case will be brought before the said Court.

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\* In Danish, the name "Teknologisk Institut" is used.