

## FEMPipe

### User Guide for the calculation tool at TechCenter Semi-Crystalline Products

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#### 1. Introduction

"FEMPipe" is the name for a calculation service of LANXESS Deutschland GmbH intended to support you during the design of several different kinds of

pipe shaped applications made out of Durethan® and Pocan®.

FEMPipe is a self-explanatory web application. You should therefore be able to use FEMPipe without further preparation.

This document contains the following information:

- Structure and function of FEMPipe
- Menus and input fields you will find while using FEMPipe
- Explanation and interpretation of the results

Should you have any further questions, please contact us via e-mail to [durethan-pocan@lanxess.com](mailto:durethan-pocan@lanxess.com).

We hope you will find FEMPipe useful and wish you much success using this tool.



## 2. Main page

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**FEMSnap**  
**FEMPipe**

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**FEMPipe**

**A** The name "FEMPipe" stands for a web based calculation service offered by LANXESS Deutschland GmbH to design pressure loaded pipelines, tanks, vessels and housings made from LANXESS thermoplastics. The program is based on the Finite-Element-Method (FEM) and allows quick and easy evaluation of above mentioned applications when analytical methods are insufficient or impractical.

**B** FEMPipe is available after a Business partner login which requires a one-time registration. Calculation results and recommendations are immediately delivered via email to the user.

**C** Following please find examples for some FEMPipe calculations:  
Example D-Pipe  
Example E-Pipe  
Example R-Pipe

**Calculation tools for several geometries**

**D** D-Pipe E-Pipe R-Pipe

**E** FEMPipe is self-explaining and needs no instructions. Nevertheless, as a help for using FEMSnap a quick guide as well as a manual (pdf) is available.

**F** In case of any question regarding the program or the results please do not hesitate to contact us by Email.

Top of page Print page bookmark

Figure 1 View of FEMPipe main page

### 2.1 Main page – explanation

At the FEMPipe's main page you will find:

**A** Introduction  
purpose and basic structure of FEMPipe

**B** Premises of use  
here you will find the requirements for the use of FEMPipe as well as the link to the registration procedure. Registration is mandatory to access this calculation tool.

**C** Examples  
showing what FEMPipe is capable of

**D** Links to the calculation of several geometries  
Icons illustrating the geometry to be chosen

**E** Help - links to  
- quick guide  
- comprehensive instructions (this manual)

**F** Contact  
Room for question, critics and suggestions



## 2.2 Main page – available shapes & geometries

To calculate such kind of applications there are three different cross-sections available. Variation in a wide range is possible by choosing adequate dimensions.

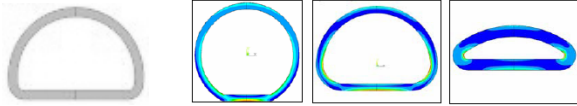


Figure 2 D-Pipe

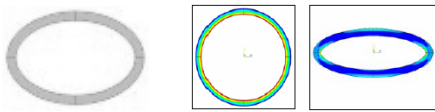


Figure 3 E-Pipe

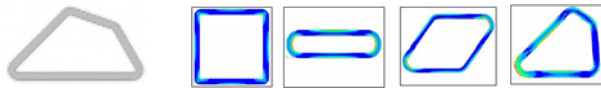


Figure 4 R-Pipe

- |   |                 |   |
|---|-----------------|---|
| 1 | Material data:  | Selection of plastic type   |
| 2 | Material grade: | Selection of specific grade   |
| 3 | Conditioning:   | Choice of the condition (dry or wet) of Durethan®   |
| 4 | Temperature:    | Selection of environmental temperature  |
| 5 | Job name:       | Title for the calculation, documentation  |
| 6 | Geometry data:  | Shape, dimensions and pressure. In order to avoid technical problems, the input of the geometry data is tied to a feasibility check which admits only technically meaningful dimensions. The allowable values are shown below the input table under the "limits" field. In order to avoid unnecessary problems, the input should be done in the given order |

## 3. Data entry form

FEMPipe: R-Pipe \_FEMPipe Home \_Quick Guide \_Manual (PDF)

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**Material Data:**

1 Material:  4 Temperature:

2 Grade:  5 Job name:

3 Conditioning:

---

**Geometry Data**

**Dimension Value**

|                    |     |
|--------------------|-----|
| e <sub>1</sub> (°) | 45  |
| s (mm)             | 3.5 |
| a (mm)             | 55  |
| b (mm)             | 45  |
| c (mm)             | 35  |
| d (mm)             | 25  |
| R (mm)             | 3.5 |
| p (bar)            | 5   |

**Limits:**

| Minimum | Maximum |
|---------|---------|
| -1      | 6.36    |

Yes, I agree to the [software license agreement](#)  
 No, I disagree to the [software license agreement](#)

Figure 5 Form before calculation

### 3.1 Data entry form - explanation

The data entry form of FEMPipe is accessible to registered users only. Its basic items are the same for all cross-section geometries and it consists of fields which should be entered in the following order:



The "calculate" button is used to start the process and the user is asked to confirm the required conditions.

**FEMPipe: R-Pipe**

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**Material Data:**

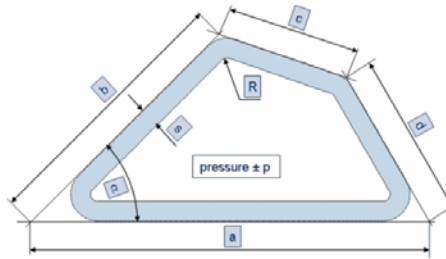
|   |               |             |   |              |           |
|---|---------------|-------------|---|--------------|-----------|
| 1 | Material:     | Durethan    | 4 | Temperature: | 23 °C     |
| 2 | Grade:        | AKV 35 H2.0 | 5 | Job name:    | example R |
| 3 | Conditioning: | YES         |   |              |           |

---

Input data to calculate your snap are forwarded in the job queue. In a few minutes you will receive a result by email.

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**Geometry Data:**




|                    |                        |
|--------------------|------------------------|
| 6                  | <b>Dimension Value</b> |
| s (mm)             | 3.5                    |
| a (mm)             | 55                     |
| b (mm)             | 45                     |
| c (mm)             | 35                     |
| s <sub>1</sub> (°) | 45                     |
| d (mm)             | 25                     |
| R (mm)             | 3.5                    |
| p (mm)             | 5                      |

---

Change all data   Clear Values   Change Values   Change some data

Figure 6 Form after sent request

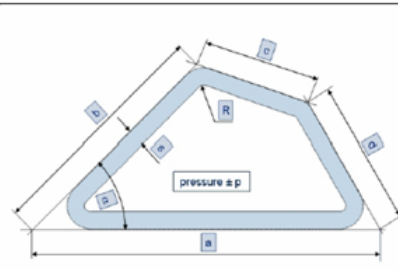
To explore design alternatives, the user may change the input data and submit other calculation requests



## FEMPipe-Service

**Input of Max Muster, Job-Name: example R**

|               |                      |
|---------------|----------------------|
| Material name | Durethan AKV 35 H2.0 |
| Temperature   | 23 °C                |
| Conditioning  | Yes                  |



| Dimension | Value |
|-----------|-------|
| s (mm)    | 3.5   |
| a (mm)    | 55.0  |
| b (mm)    | 45.0  |
| c (mm)    | 35.0  |
| d (mm)    | 25.0  |
| R (mm)    | 3.5   |
| s1 (mm)   | 45.0  |
| p (bar)   | 5.0   |

Thank you for using our service.

Figure 8 calculation results (example)

#### 4. Calculation results

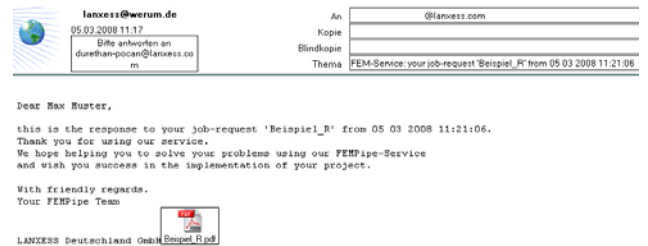
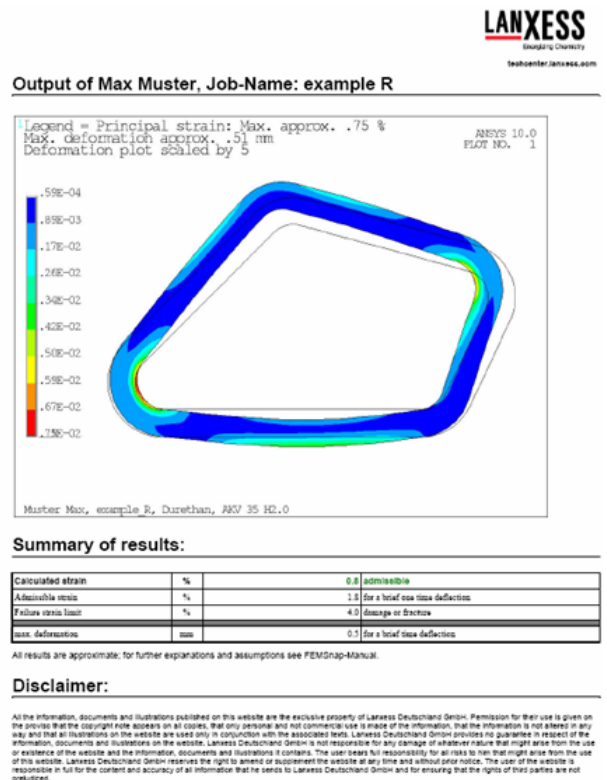


Figure 7 responding e-mail

The calculation results are delivered per e-mail to the user as a pdf-document (Figure 8).

According to experience, you should not need to wait longer than five minutes for your results. Longer delivering times may be due to a slow mail delivery system or at a strong utilization of the calculation module.



#### 4.1 Calculation results - explanation

The pdf-document consists of two pages. On the first page, the entire input is documented. The second page contains graphics of the strain distribution in the distorted condition.

The legend shows contour plot colors corresponding to the maximum principal strains in percentage values.

- Calculated strain            maximum principal strains in percentage for the chosen temperature and a short time load, including a comment on whether the maximum value is allowable or not for the specific material in question
- Admissible strain            allowable strain for a one-time short time loading for the corresponding ambient temperature
- Failure strain limit        strain-value from which permanent deformation (major plastic strain) or failure (break) is to be expected. The gap between the admissible strain and the failure strain limit is an area the designer may use if he has made positive experiences with similar parts. Verification that the part will meet the requirements in practical use will be the manufacturer's responsibility.
- Maximum Deflection        force magnitude that results in the specified deflection for the chosen material

FEMPipe-calculations are based on linear material-data, as a Secant-Modulus at approx. 1 % strain and a Poisson-ratio of 0.4. Due to it, under unfavorable conditions (local strain concentrations and high strain values), the calculated deflections force can

be afflicted by a small error. As in this case the strain values are not allowable respectively the design has to be optimized, the error is not of importance. Inside the allowable strain-frame, this error might be insignificant.

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This information and our technical advice - whether verbal, in writing or by way of trials - are given in good faith but without warranty, and this also applies where proprietary rights of third parties are involved. Our advice does not release you from the obligation to verify the information currently provided - especially that contained in our safety data and technical information sheets - and to test our products as to their suitability for the intended processes and uses. The application, use and processing of our products and the products manufactured by you on the basis of our technical advice are beyond our control and, therefore, entirely your own responsibility. Our products are sold in accordance with the current version of our General Conditions of Sale and Delivery.

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