FEMPipe

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

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® und 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.

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

2. Main page

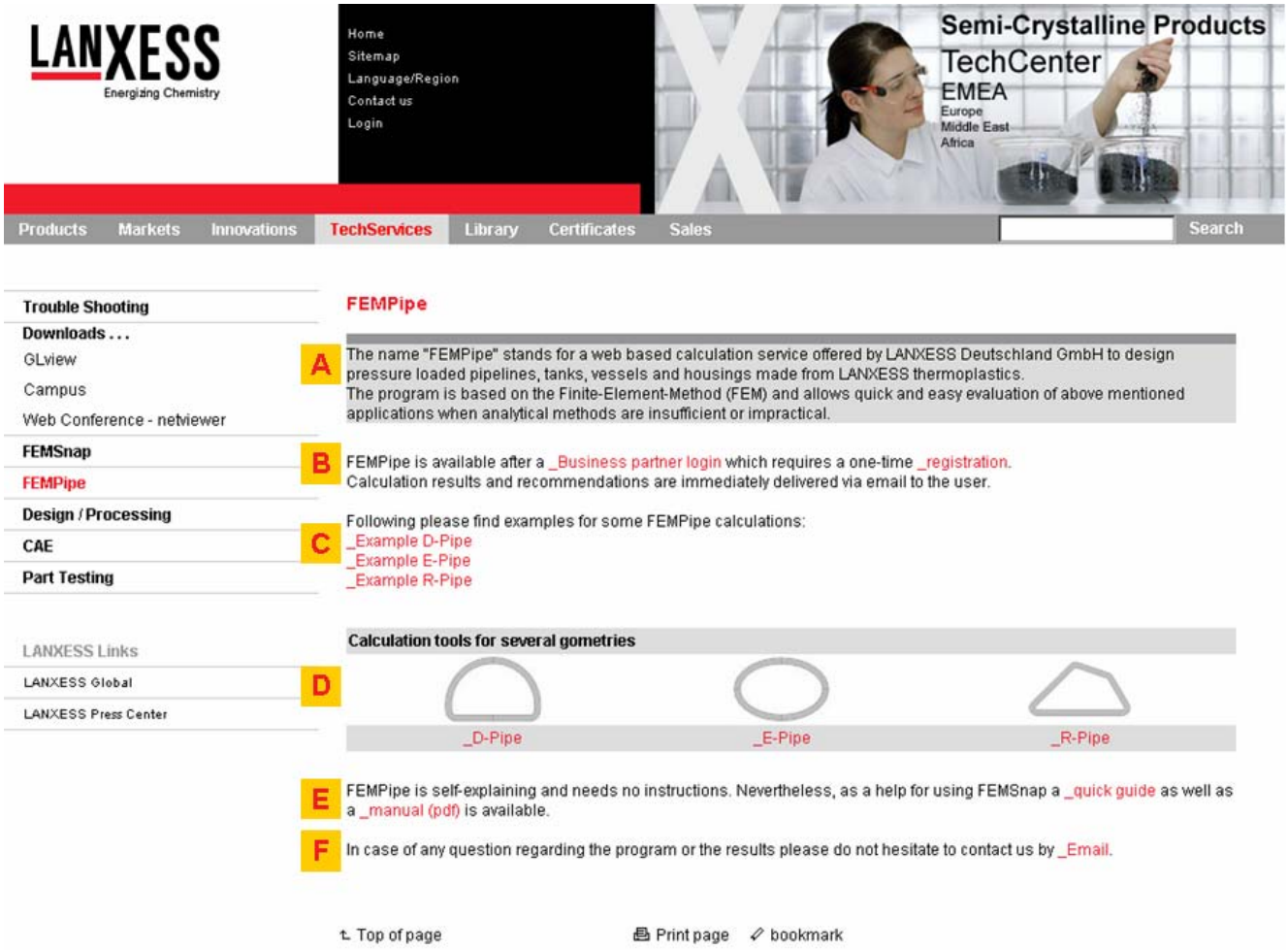

Figure 1 View of FEMPipe main page

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.

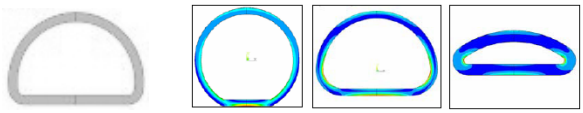

Figure 2 D-Pipe

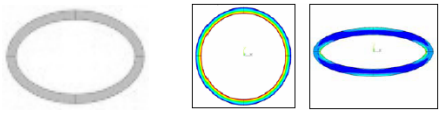

Figure 3 E-Pipe

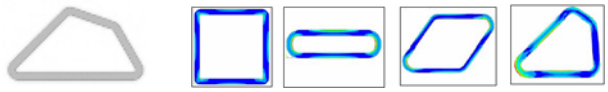

Figure 4 R-Pipe

3. Data entry form

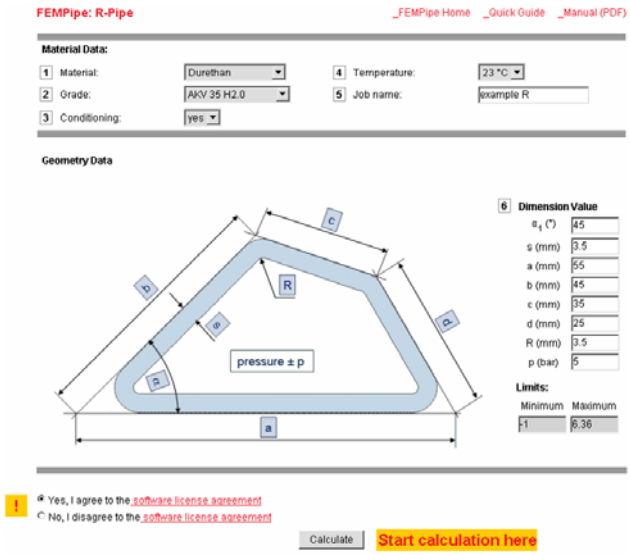

Figure 5 Form before calculation

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:

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

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

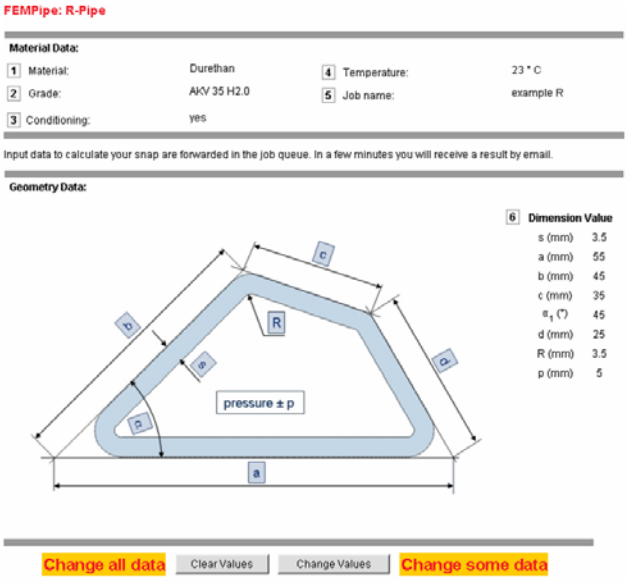

Figure 6 Form after sent request

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

4. Calculation results

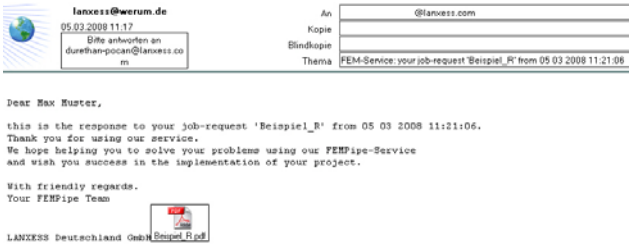

Figure 7 responding e-mail

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.

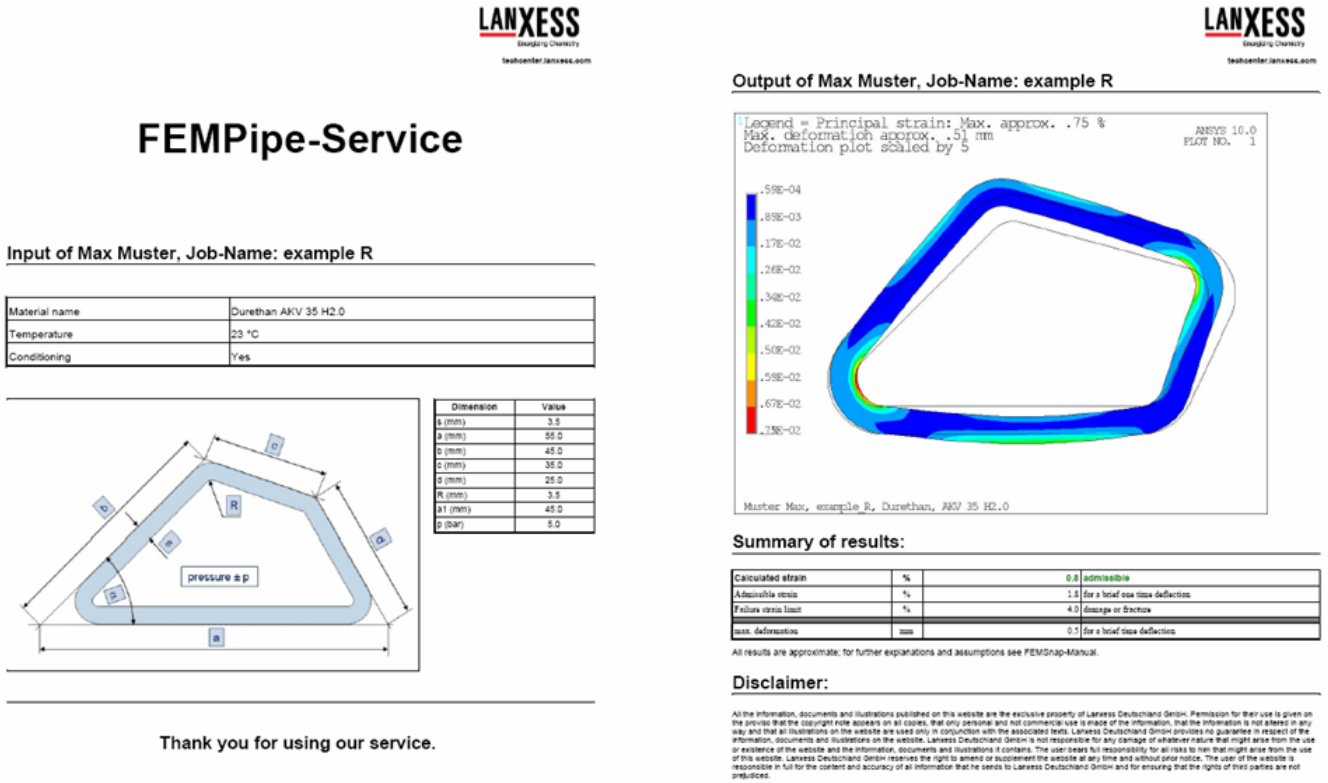

Figure 8 calculation results (example)

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.