

FEMSnap

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

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1. Introduction

"FEMSnap" is the name for a calculation service of LANXESS Deutschland GmbH intended to support you during the design of several different kinds of snap fits made out of Durethan® und Pocan®.

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

This document contains the following information:

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

Should you have any further questions, please contact us via email to durethan-pocan@lanxess.com.

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



2. Main page

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FEMSnap

A The name "FEMSnap" stands for a web based calculation service offered by LANXESS Deutschland GmbH to design a variety of snap-fits made from thermoplastics. The program is based on the Finite-Element-Method (FEM) and allows quick and easy evaluation of snap-fits when analytical methods are insufficient or impractical.

B FEMSnap 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 two examples for FEMSnap calculation results:
[_example I-Snap R1](#)
[_example L-Snap](#)

Calculation tools for several snap-fit geometries

D

- [_I-Snap R1](#)
- [_I-Snap R2](#)
- [_I-Snap RS1](#)
- [_I-Snap RS2](#)
- [_L-Snap](#)
- [_V-Snap](#)
- [_C-Snap](#)
- [_O-Snap](#)
- [_S-Snap](#)
- [_T-Snap](#)
- [_B-Snap](#)

E 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 FEMSnap main page view

2.1 Main page – explanation

At FEMSnap's main page you will find:

- A** Introduction
purpose and basic structure of FEMSnap
- B** Premises of use
here you will find the requirements for the use of FEMSnap as well as the link to the registration procedure. Registration is mandatory to access this calculation tool.

- C** Examples
showing what FEMSnap is capable of
- D** Links to the calculation of several geometries
Icons illustrating the snap-fit to be chosen
- E** Help - links to
- quick guide
- comprehensive instructions (this manual)
- F** Contact
Room for question, critics and suggestions



3. Data entry form

FEMSnap: I-Snap R1

[_FEMSnap Home](#) [_Quick Guide](#) [_Manual \(PDF\)](#)

Material Data:

1 Material:	Durethan	2 Grade:	AKV 30 H2.0
3 Temperature:	23 °C	4 Coefficient of friction:	0.5
5 Job name:	Example 1	6 Conditioning:	yes

Geometry Data:

7 Dimension	Value
H ₁ (mm)	3.5
H ₂ (mm)	2
H ₃ (mm)	1.5
B ₁ (mm)	9
B ₂ (mm)	4
L ₁ (mm)	15
R ₁ (mm)	0.75
α ₁ (°)	30
α ₂ (°)	70
y (mm)	1.45

Limits:

Minimum	Maximum
>0	7.5

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

Calculate

Figure 2 Form before calculation

3.1 Data entry form - explanations

The data entry form of FEMSnap is accessible to registered users only. Its basic items are the same

- | | |
|----------------------------|---|
| 1 Material data: | Selection of plastic type |
| 2 Material grade: | Selection of specific grade |
| 3 Temperature: | Selection of environmental temperature |
| 4 Coefficient of friction: | Selection of the coefficient of friction |
| 5 Job name: | Title for the calculation, documentation |
| 6 Conditioning: | Choice of the condition (dry or wet) of Durethan® |
| 7 Geometry data: | Dimensions of the snap-fit and the deflection. In order to avoid technical problems, the entry 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.

To explore design alternatives, the user may change the input data and submit other calculation requests (Figure 3).

FEMSnap: I-Snap R1

Material Data:

1 Material:	Durethan	2 Grade:	AKV 30 H2.0
3 Temperature:	23 °C	4 Coefficient of friction:	0.5
5 Job name:	Example 1	6 Conditioning:	yes

Geometry Data:

7 Dimension	Value
H ₁ (mm)	3.5
H ₂ (mm)	2
H ₃ (mm)	1.5
B ₁ (mm)	9
B ₂ (mm)	4
L ₁ (mm)	15
R ₁ (mm)	0.75
α ₁ (°)	30
α ₂ (°)	70
y (mm)	1.45

Limits:

Minimum	Maximum
>0	7.5

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

Clear Values Change Values

Figure 3 Form after start of calculation

for all snap-fit geometries and it consists of following fields which should be entered in the following order:

4. Calculation results

The calculation results are delivered per e-mail to the user as a pdf-document (Figure 4).

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.

femsnap@lanxess.com
 30.01.2008 09:17
 Bitte anrufen an
 femsnap@lanxess.com

As: @lanxess.com
 Kopie:
 Blindkopie:
 Thema: FEM-Service: your job-request 'Example_1' from 30.01.2008 09:20:45

Dear Max Muster,
 this is the response to your job-request 'Example_1' from 30.01.2008 09:20:45.
 Thank you for using our service.
 We hope helping you to solve your problem using our FEMSnap-Service
 and wish you success in the implementation of your project.

With friendly regards,
 Your FEMSnap Team



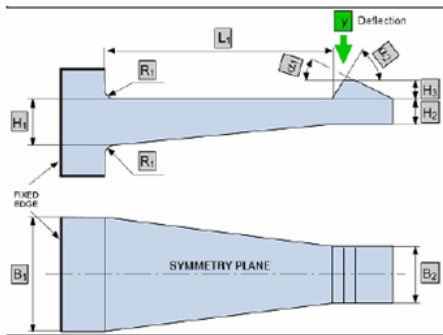
LANXESS Deutschland GmbH (Example 1).pdf



FEMSnap-Service

Input of Max Muster, Job-Name: Example 1

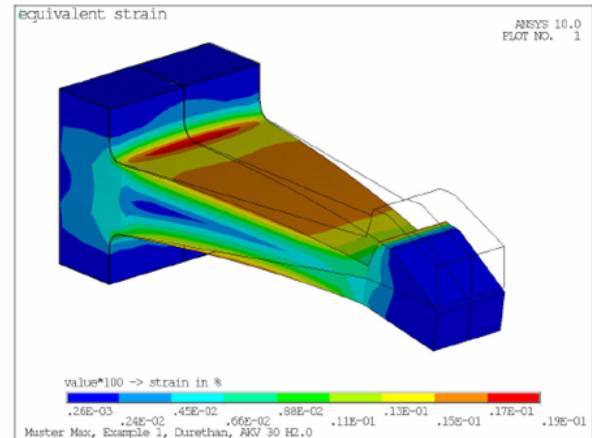
Material name	Durethan AKV 30 H2.0
Temperature	23 °C
Conditioning	Yes
Coefficient of friction	0.6



Dimension	Value
H1 (mm)	3.5
H2 (mm)	2.0
H3 (mm)	1.5
B1 (mm)	9.0
B2 (mm)	4.0
L1 (mm)	15.0
R1 (mm)	0.75
α1 (°)	30.0
α2 (°)	70.0
γ (mm)	1.45

Thank you for using our service.

Output of Max Muster, Job-Name: Example 1



Summary of results:

Calculated strain	%	1.3	inadmissible
Admissible strain	%	1.9	for a brief use time deflection
Failure strain limit	%	4.0	damage or fracture
Deflection force	N	91.5	in the y direction
Insertion force	N	138.5	
Pull-out force	N	undetermined	insufficient, see manual

All results are approximate; for further explanations and assumptions see FEMSnap-Manual.

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Figure 4 calculation results (example)

4.1 Calculation results - explanations

The pdf-document consists of two pages. On the first page, the entire input is documented. The sec-

ond page contains graphics of the strain distribution of the snap-fit in the distorted condition. The legend shows contour plot colors corresponding to the maximum principal strains in percentage values.



Below the graphic results, a table shows the following values:

- Calculated strain maximum principal strains in percentage 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 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.
- Deflection force force magnitude that results in the specified deflection for the chosen material
- Insertion force force magnitude to assemble the snap-fit
- Pull-out force force magnitude to disassemble the snap-fit

FEMSnap-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 an error of about 25 %. As a rule, the calculated deflection forces are expected to be too high.

The insertion and pull-out force are determined by the calculated deflection force, the slant angle (α_1 or α_2) and the coefficient of friction (μ). In theory, the forces needed for insertion and pull out become

infinitely high when the slant angle and the friction angle ($\rho = \arctan \mu$) add up to 90° or more. In this case, no values but the comment "undetermined" is shown, i.e., there is no solution for the snap-fit and the snap-fit is considered to be inseparable.

Since the force values are strongly dependent on friction and the assembling conditions, the user is advised to keep the calculate forces only as a theoretical order of magnitude.

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