PolPartDesign - Tools for the development and design of plastic moulded parts

Table of contents

Introduction

This software has been developed to assist you with tasks within your department. By using advanced technologies and algorithms, we have managed to create a user-friendly and efficient software that will help you perform your work faster and more accurately.

In this introduction, we will explain the basic functions and tools that will help you work with the software. We recommend that you read this guide carefully to realise the full potential of the software.

Module*: Calculation of snap fits*

- **12 different types of connections**, connection principles and spring elements.
- Acquisition of the required geometric data of the spring elements or connection types
- Variation by selecting **different snap-in elements** (trapezoidal snap-in, bead snap-in, triangular snap-in, ...)
- Variation by selecting **different cross-section geometries**
- Calculation module for approximate determination of the ***E-modulus***
- Calculation module for the approximate determination of the ***E_0-modulus*** by means of the Shore hardness
- Calculation module for the approximate determination of the ***friction coefficient***
- Calculation module for the approximate determination of the ***permissible elongation***

Module: *Calculation of plastic spur gears*

- The subject is the calculation of plastic spur gears following DIN 3990.
- Included are zero gears with 20° involute gearing with spur and helical gearing as well as plastics with a modulus of elasticity (modulus of origin) according to DIN EN ISO 527 E_0 > 300 N/mm^2 or with a Shore hardness according to DIN EN ISO 7619 > 60D.
- If necessary, gears with profile shift can be calculated by modifying and specifying the relevant calculation variables and influencing factors according to DIN 3990.
- The mathematical load capacity verifications include the tooth root strength, tooth flank pressure, tooth deformation as well as tooth mass and tooth flank temperature with specification of the corresponding mathematical safeties.
- Strength verifications and temperature checks for metal gears in combined gearboxes are **not** calculated.
- Calculations for multi-stage gearboxes can be managed/processed as individual projects (if the corresponding power split is observed).

Module: *Calculation of cylindrical plastic tanks*

- for continuous constant static load by specifying the fill level with possible variation of the liquid temperature
- for interrupted (intermittent) loading by specifying the same or different load cycles. A load cycle in this context is a load pattern by specifying the time, a constant liquid temperature and minimum or maximum fill levels. The overall load scheme can contain one or more load cycles.
- Calculation of the minimum wall thickness
- Geometric specifications for the areas of maximum load

- Strength verification
- for isotropic and orthotropic plastics
- Calculation module for the approximate determination of the modulus of elasticity
- Calculation module for the approximate determination of the E0 modulus using the Shore hardness
- Calculation module for the approximate determination of the coefficient of friction
- Calculation module for the approximate determination of the permissible elongation

Quick start

On the left side of the main window, select the tab for the desired programme module.

Quick start - Calculation of snap connections
Quick start - Calculation of plastic spur gears
Quick start - Calculation of cylindrical plastic tanks

Snap connections

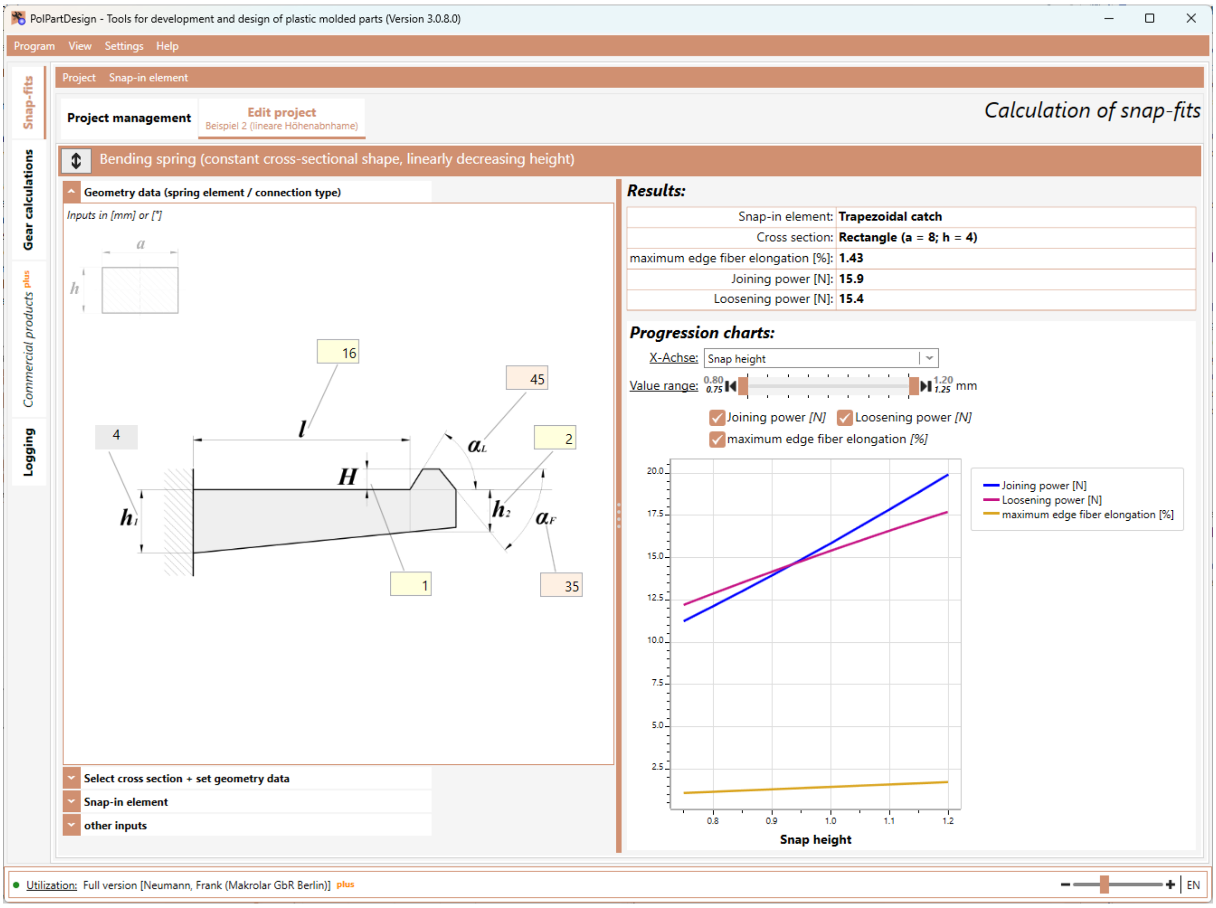
The software contains, among other things, a module for ***snap fit calculations***. This is **a component** available under the software "*Tools for development and design of plastic mouldings*".

Further software components are in progress and will then be made available via corresponding updates.

This help is essentially intended to support you in the use/operation of the software. If you are currently using the free **trial version** of the software, the differences to the **full version** will be pointed out at the appropriate place (in this help as well as within the software).

1. Create a new project in the "Project management" tab. In the following, the basic data/entries are entered step by step.
2. The "Edit project" tab is then displayed. Here you can complete or specify your entries/decisions.
3. As soon as all entries/decisions have been made, the result is displayed on the right.
4. If inputs are still missing or if they are incorrect, corresponding notes are displayed on the right. In this case, the results or progress diagrams are not visible/deactivated.
5. As soon as a first result is available, you can now change each of your inputs accordingly and immediately evaluate the effects on the result.
6. In addition, you can have the values for *joining power*, *release power*, *deflection power (tilting movement)* and *max. edge fibre elongation* displayed graphically in an additional diagram view (depending on the type of connection or spring element). Geometry data as well as material or application data can be selected as parameters. This graphical view is also updated immediately when you change inputs and decisions of the project.

Screenshot example:



Plastic spur gears

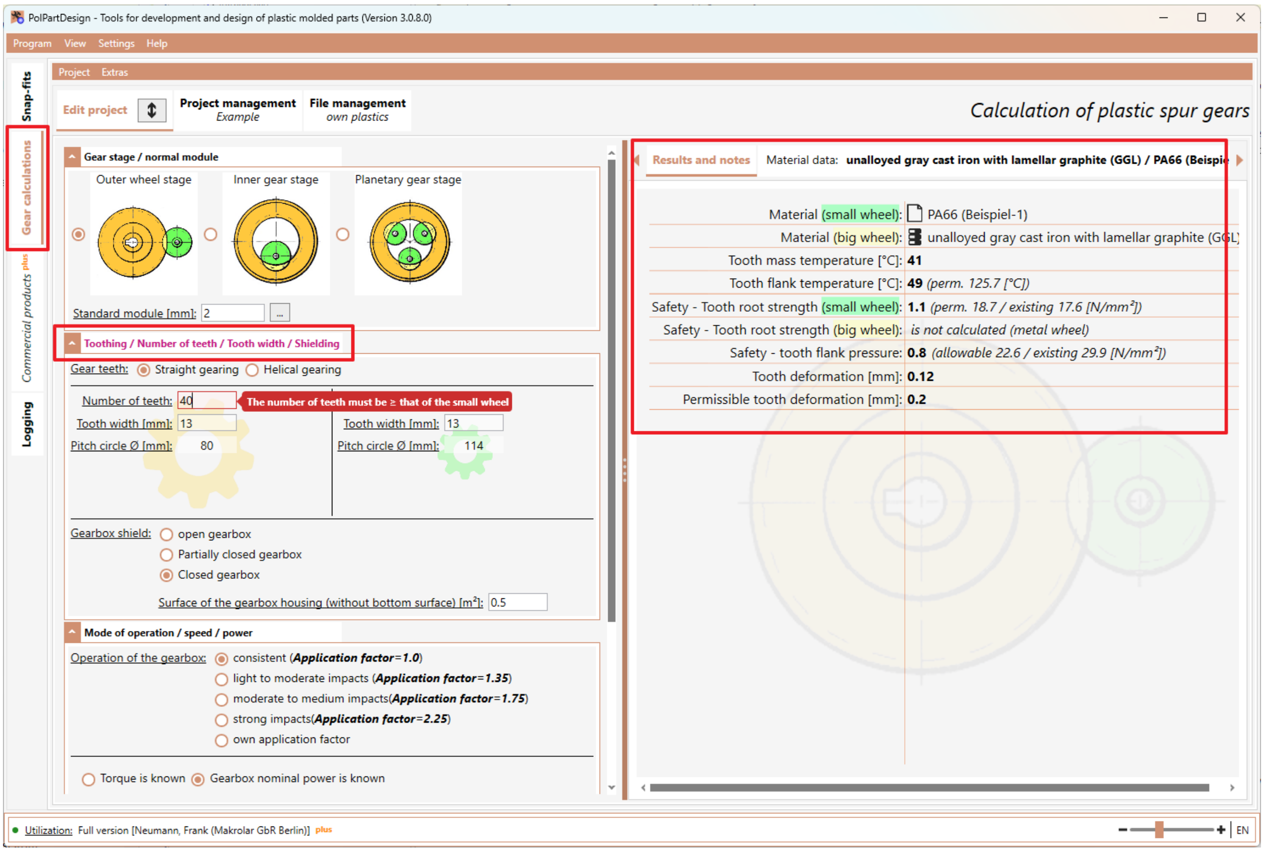
The software contains, among other things, a module for calculations of plastic spur gears. This is **a component** available under the software "*Tools for development and design of plastic moulded parts*".

Further software components are in progress and will then be made available via corresponding updates.

This help is mainly intended to support you in the use/operation of the software. If you are currently using the free **trial version** of the software, the differences to the **full version** will be pointed out at the appropriate place (in this help as well as within the software).

- After starting the software, the main window appears and the tab "*Gear calculations*" is currently selected. Within this tab, the "*Edit project*" tab is again active.
- The various required inputs are now grouped here. The individual groups have a heading. The font colour of the heading is **red** if required inputs are missing or incorrect in the group. Click in the heading or on the arrow symbol on the left to show/hide the corresponding inputs.
- Edit the required inputs/decisions for all groups. As soon as all required inputs/decisions are complete and correct, the results are displayed on the right side of the tab.
- You can now change inputs/decisions as you wish and immediately evaluate the effects of your changes in the results on the right.

<u>Screenshot example</u>:



- The software is delivered with a local database (see also: Database data), which contains common plastics and metals. In addition, however, you can also add/manage your own plastics and use them for the calculations (see also File management (own plastics)).

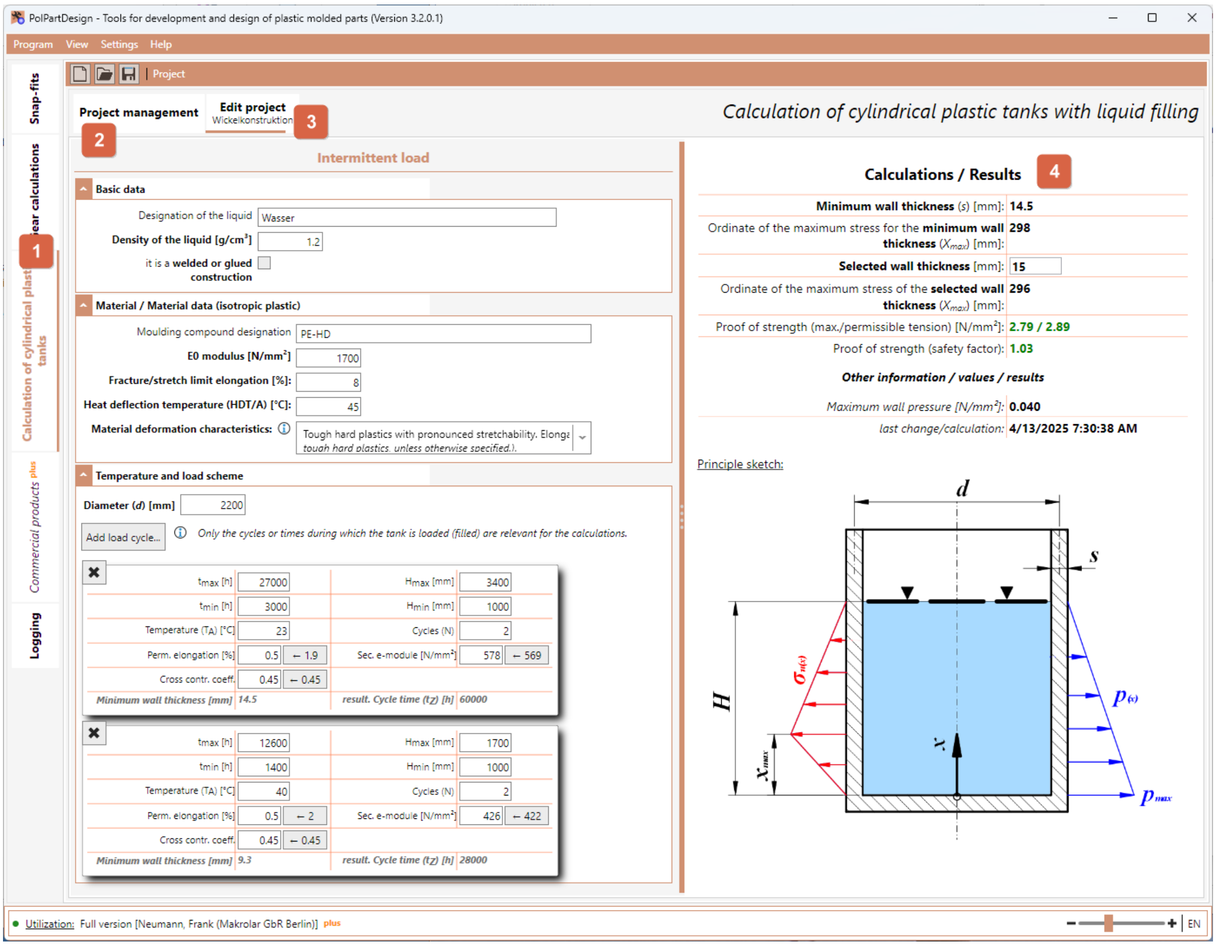
Plastic tank

The software contains, among other things, a module for the calculation of plastic tanks with liquid filling **1**. This is **a component** that is available under the software “*Tools for the development and design of plastic moulded parts*”.

Further software components are currently being developed and will be made available via corresponding updates as soon as they become available.

This help is primarily intended to support you in using/operating the software. If you are currently using the **trial version** of the software, the differences to the **full version** will be pointed out at the appropriate point (in this help and within the software).

1. Create a new project in the “Project management” **2** tab. The basic data/entries are then input step by step.
2. The “Edit project” tab **3** is then displayed. You can now complete or specify your entries/decisions here.
3. As soon as all inputs/decisions have been made, the result **4** is displayed on the right.
4. As soon as an initial result is available, you can now change each of your inputs accordingly and immediately evaluate the effects on the result.



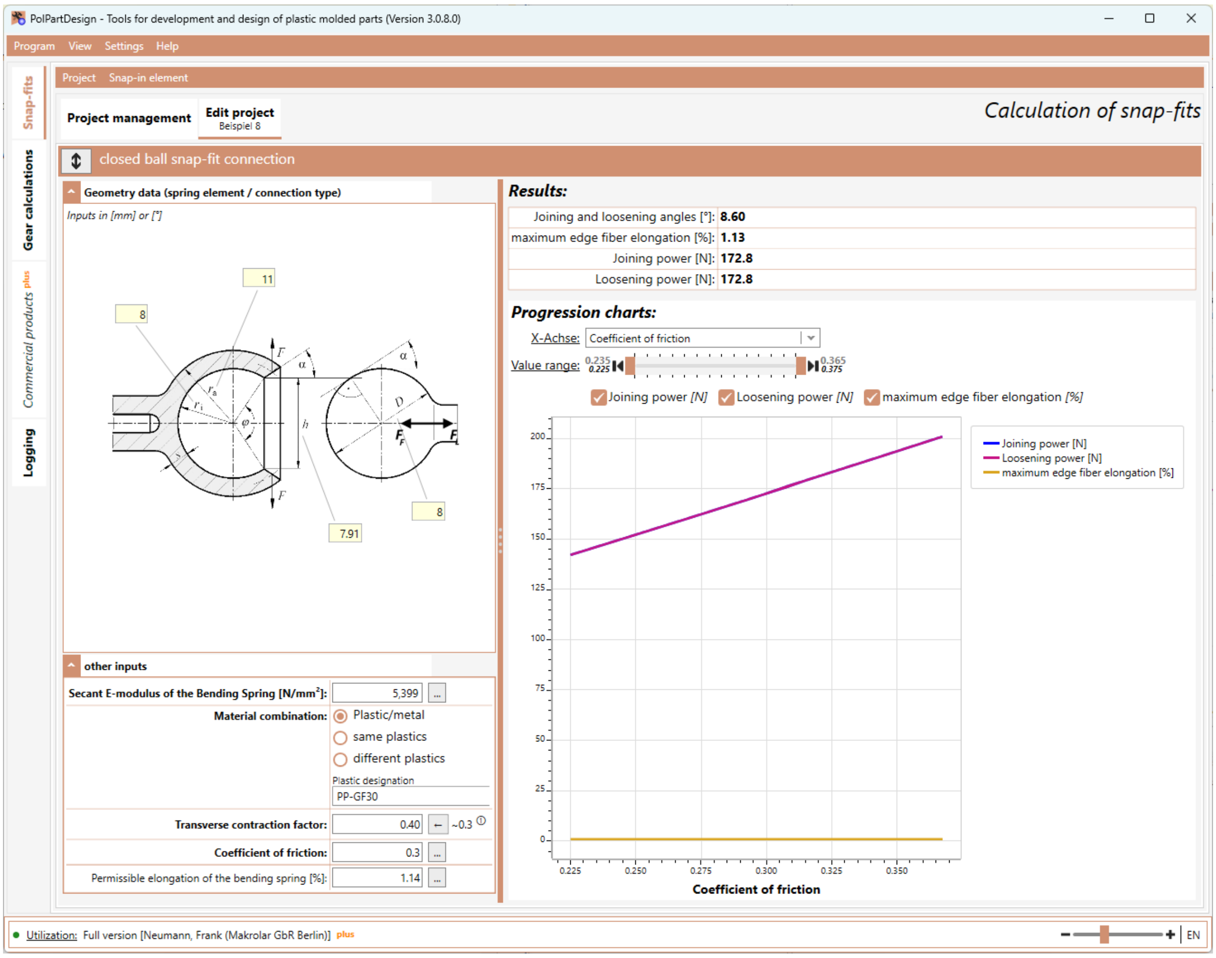
Calculation of snap connections

Snap connections are a type of connection technology that is often used in applications where quick and easy assembly is required without having to use screws or rivets, for example.

A snap connection usually consists of two parts that can be joined together by simply pressing them together. The connection remains secure and stable as long as it is loaded, and can be quickly and easily released at any time by separating the two parts.

Snap connections come in many different designs and sizes, depending on the specific requirements of the application.

Screenshot example:

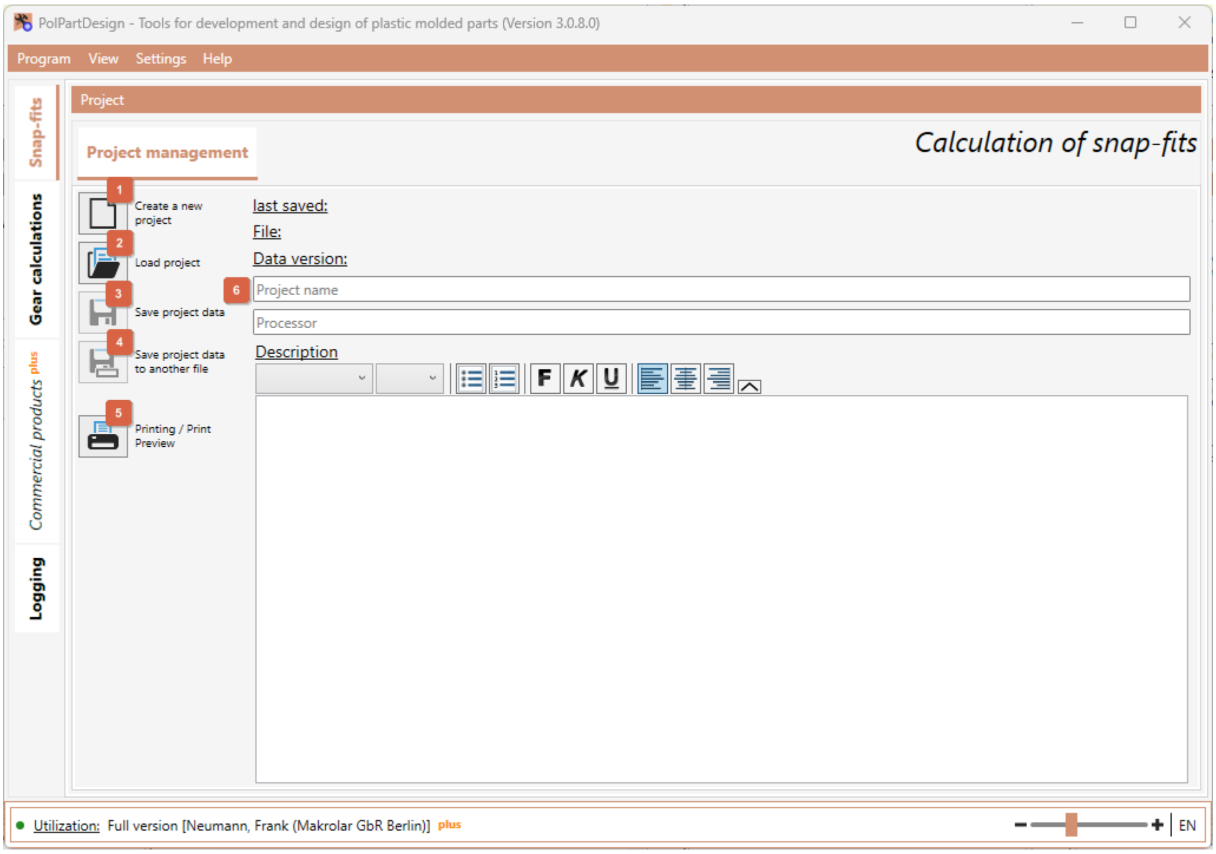


Operation

[Project management](#)
[Edit project](#)

Project management

As long as no project has been loaded or newly created, you will be in the View/tab *Project Management*.



Here you can create a new project 1, load an existing project 2, save the current data of a project 3 or save the project under another name/other file 4.

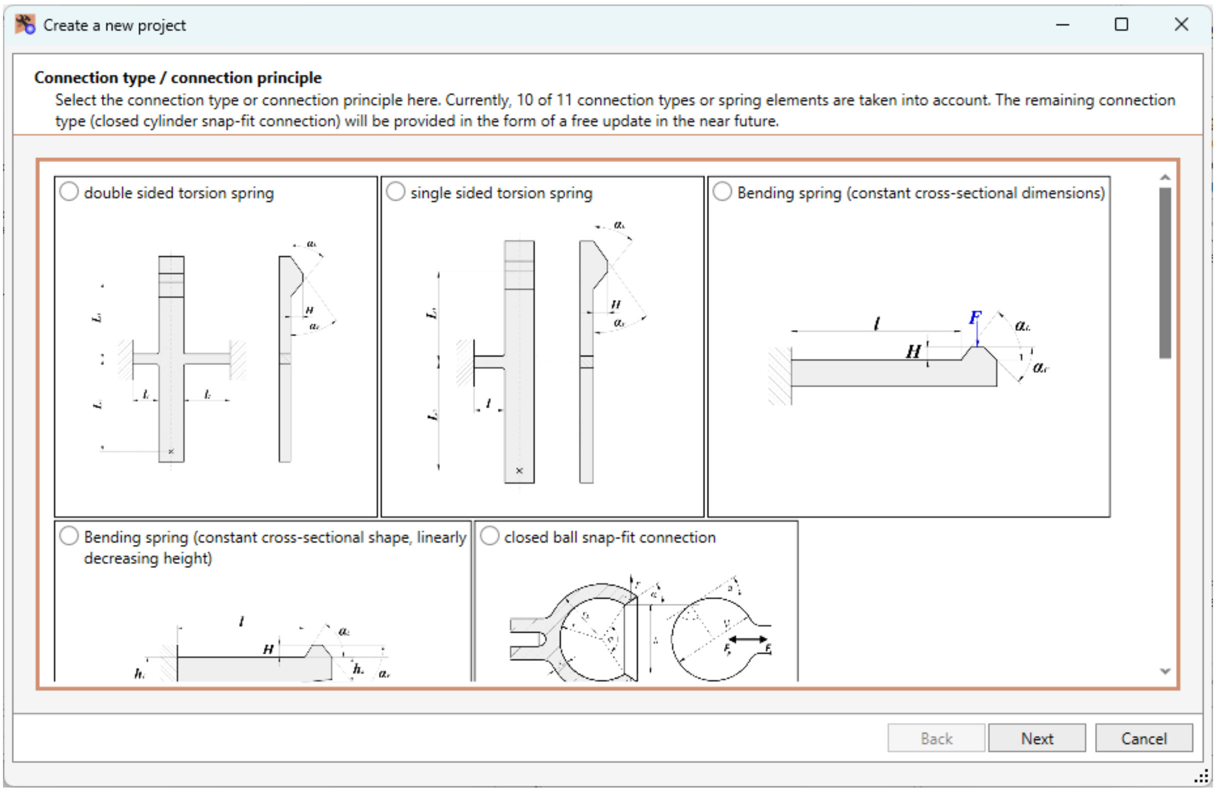
Projects are saved as individual files. To be able to save a file or a project, at least the project designation 6 must be entered.

To print or for the print preview, click the corresponding button 5.

Create new project

- Click on the *Create new project* button in the *Project management* tab.
- A window then opens in which the minimum data for a project are requested step by step.
- The minimum data are the *type of connection* or *the connection principle*, the *latching element* and information on the *material combination*.
- You can close the window at any time and make or change the inputs later within the project. To do this, click on [*Continue*] and at the end on [*Finish*].

Screenshot example (selection of connection type/principle):



When you have closed the window via [*Finish*], the system automatically switches to the project view. Here you can now enter all missing data and correct/precise existing data.

If necessary, switch to the *Project Management* tab again to save your inputs. There is also a corresponding menu item in the main menu *Project* to save the data.

If it is a new project, you will be asked to specify a file name and a storage location when saving.

Load project

Click on the corresponding button in the *project management* to load an existing file.

A window then opens in which you can select the file.

After the file has been loaded, the view automatically switches to the *Edit Project* tab. The data is displayed here and can then be specified/modified.

If all the required data is available, the result is immediately displayed or updated.

Edit project

Connection type / spring element
Snap-in element
Spring element cross sections
other inputs

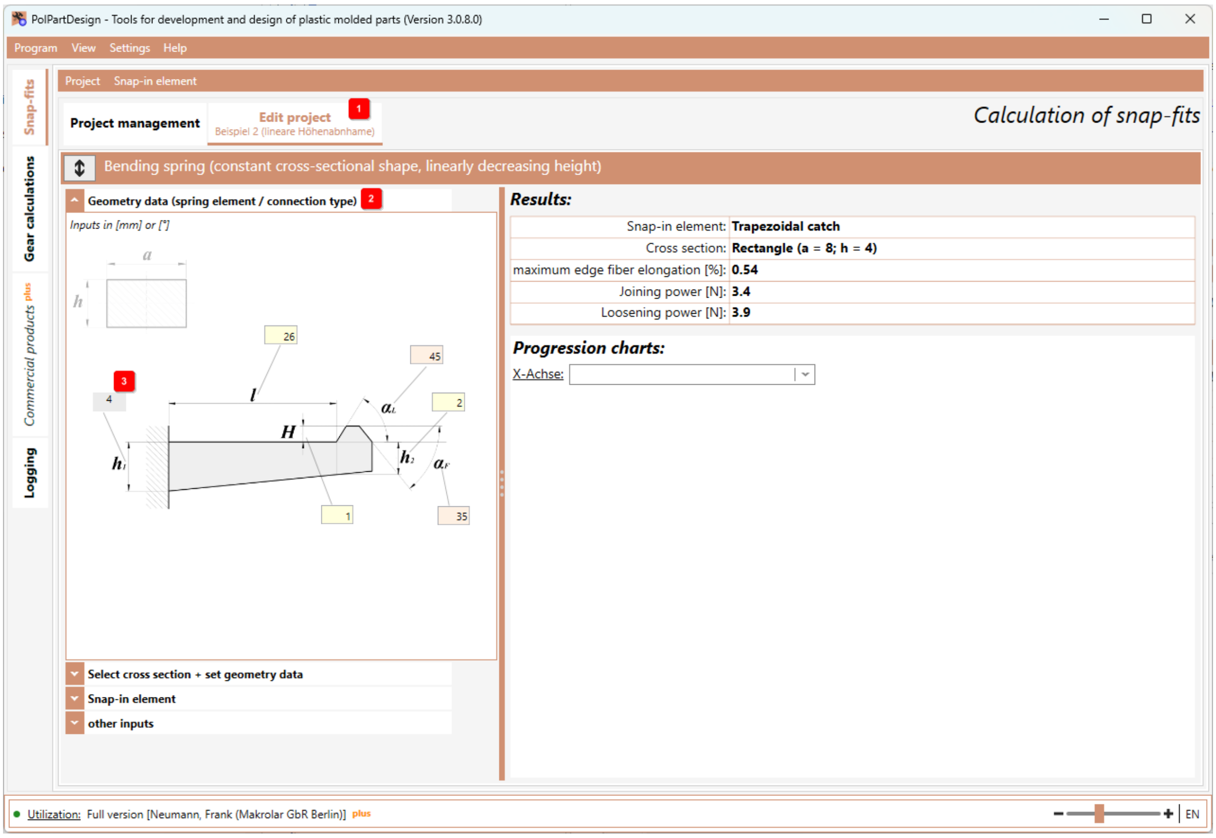
Connection type / spring element

The connection type or the spring element are basic data of each project and cannot be subsequently changed within a project.

To edit another connection type or spring element, simply create a [new project](). Afterwards, all data is displayed in the register Edit project 1 and can be further specified.

At the top position you will find the inputs for geometry data (*spring element / connection type*) 2. Here you enter the data on the geometry of the spring element or the connection type.

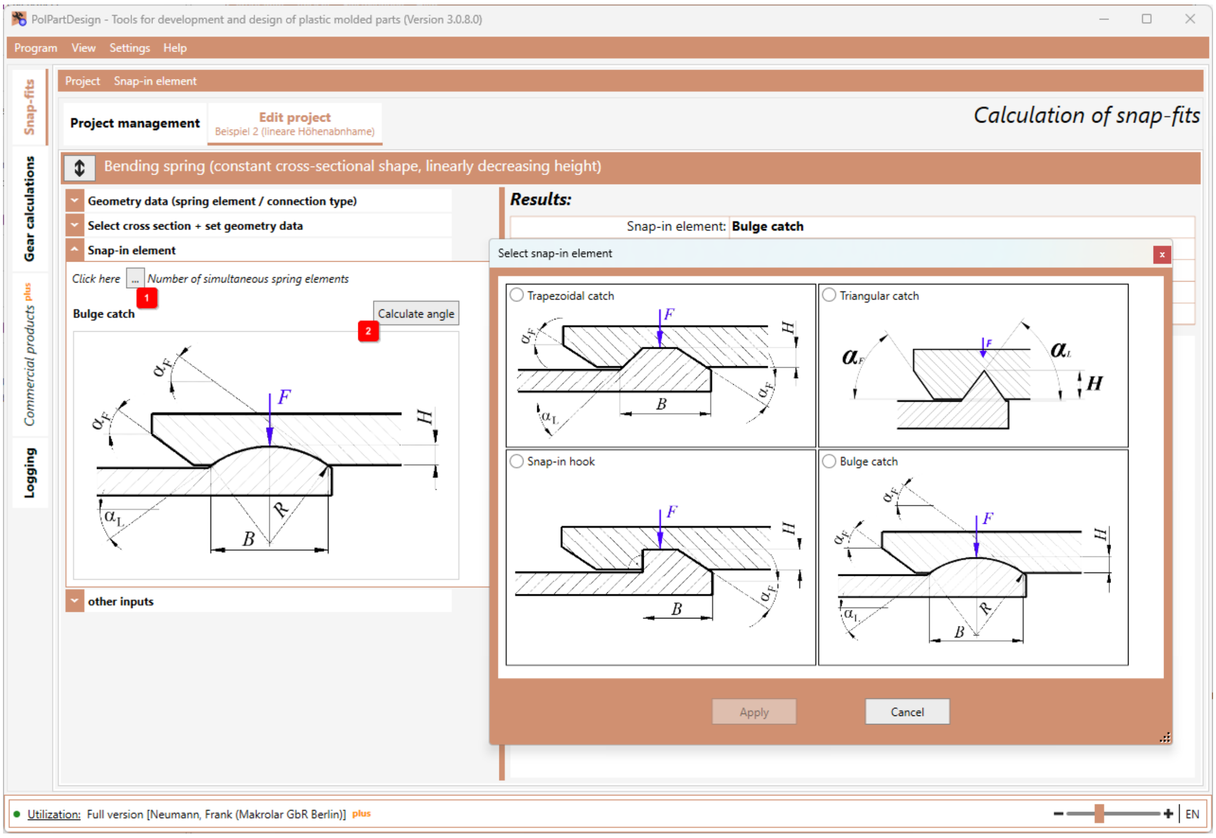
Note: *For bending springs with linear height or width decrease, the cross-section inputs correlate with the height and width specifications at the clamping point. Therefore the height or width at the spring element/connection type is only displayed and cannot be edited* 3.



Snap-in element

Their current selection is displayed in the *Snap-in Element* tab.

Via the switch [...] 1, you can subsequently assign a different snap-in element. In this case, the values for the joining and release angles are deleted and must be entered again.

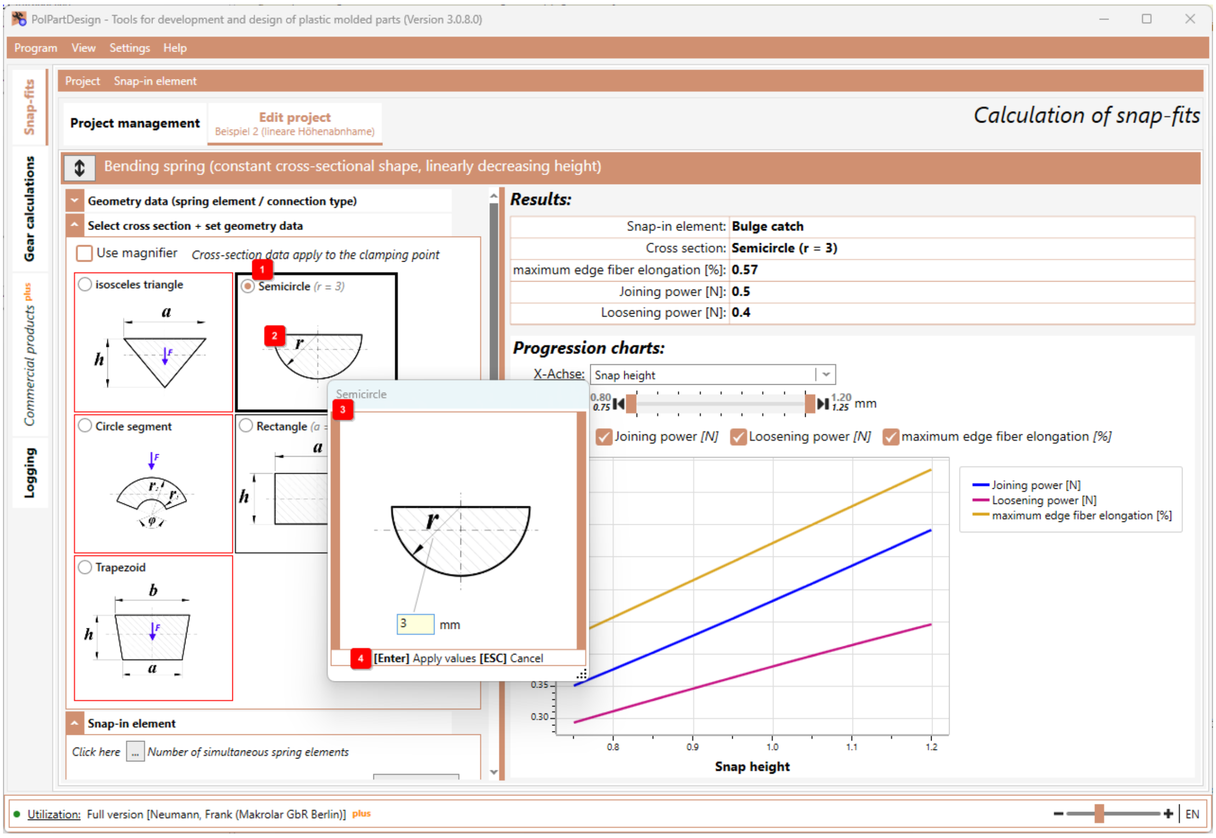


- If you have selected the *snap-in hook* as the snap-in element, 90° is automatically entered as the release angle ("undetachable connection").
- If you have selected the *bulge snap-in element* as the snap-in element, you can calculate the joining and release angles 2 and accept them.
- The selection of snap-in elements depends on the type of connection or the spring element. For example, no snap-in element can be selected for a closed ball-snap connection.

Spring element cross sections

In the *Cross-sections* tab, the possible cross-sections for the snap-in element are displayed. The possible cross-sections depend on the selected connection type or spring element.

The cross-section dimensions always apply at the clamping point.



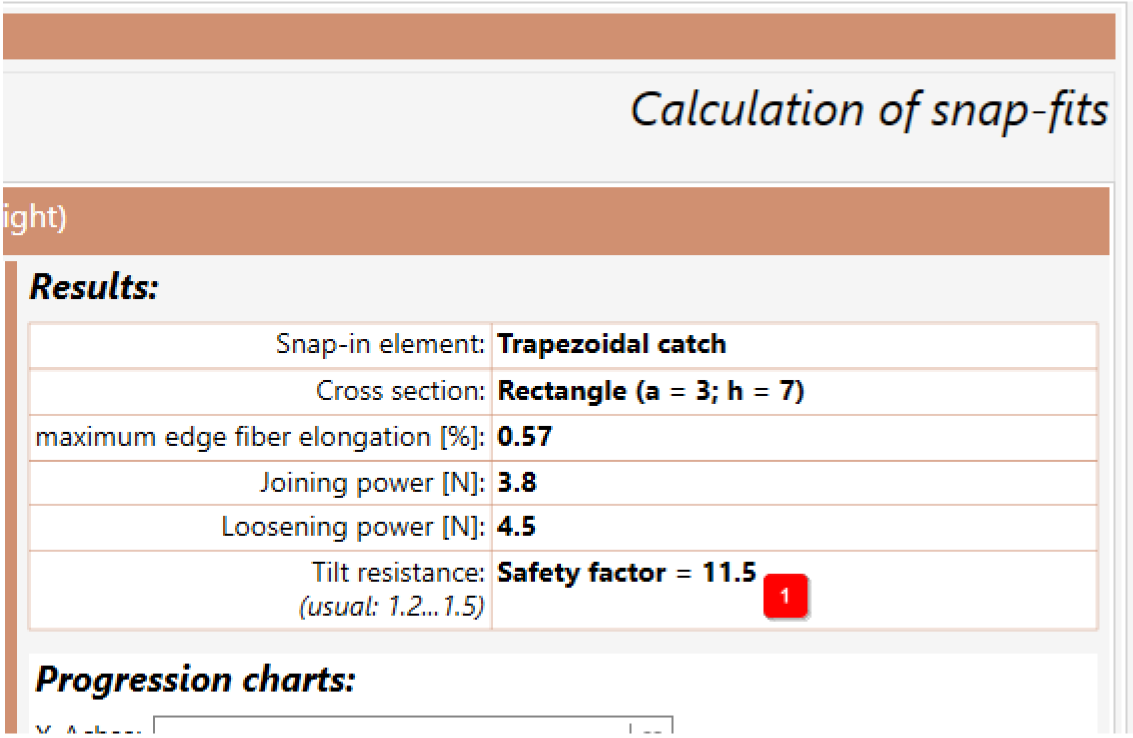
- To select a cross-section, click with the mouse on the corresponding designation 1.
- to define/edit the geometric data of the cross-section, double-click with the mouse in the graphic 2. A further window 3 will then open in which the geometric data can be entered.
- Press the Enter key 4 to accept the entries. Or press the ESC key to cancel the entry.

Note: *For bending springs with linear height or width decrease, the cross-section entries correlate with the height and width specifications at the clamping point. Therefore, the height or width at the spring element/connection type is only displayed and cannot be edited.*

Rectangular cross-section

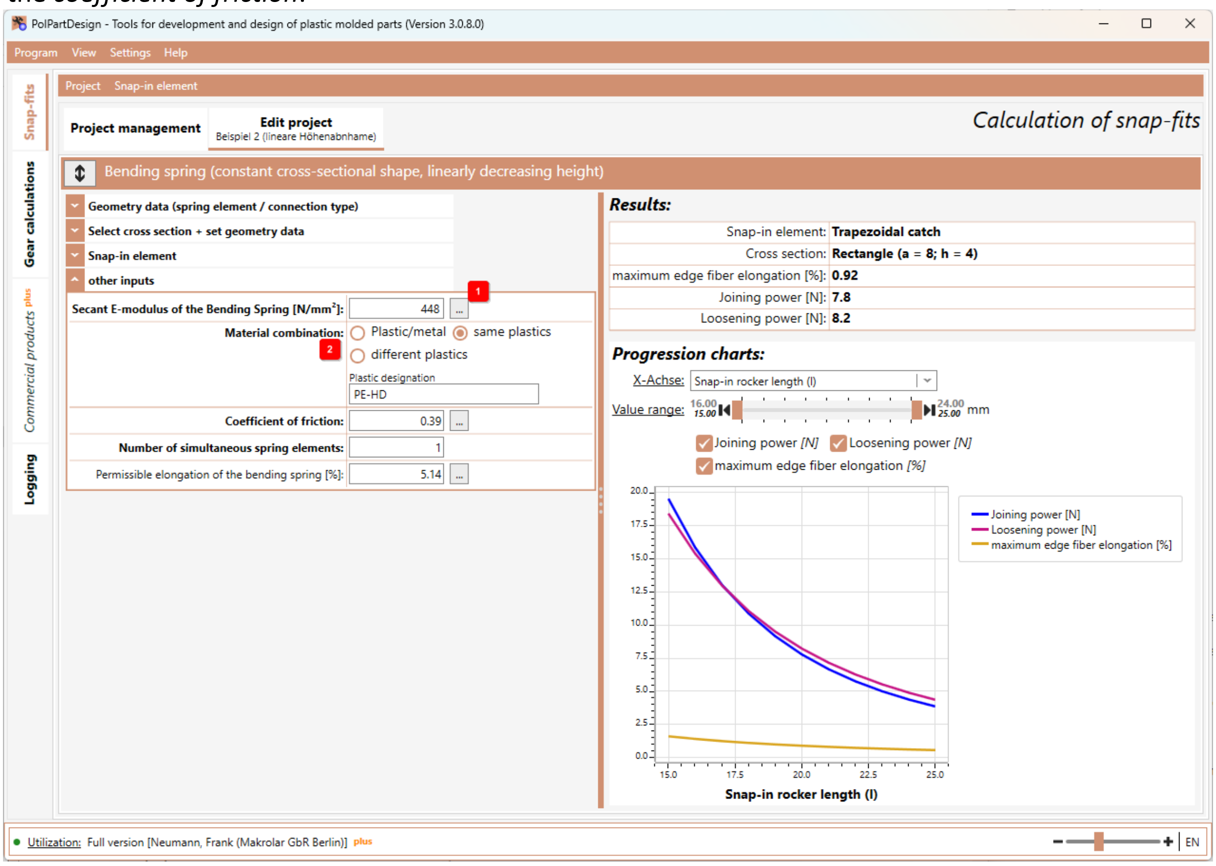
Control of the tilt stability:
In the case of straight bending springs with a rectangular cross-section whose **height** is **greater than** the **width** due to special design requirements, there may be a risk of instability due to beam tilting.

In this case, the safety against tilting is also indicated in the results 1. The limit values of usual safety factors are in the range of 1.2 ... 1,5.



other inputs

For the other inputs, you can simply enter the corresponding values or have them calculated roughly. For example, we have integrated **calculation modules** for *E-modulus*, *E_0-modulus*, the *permissible elongation* and the *coefficient of friction*.



Select the button **1** next to it to call up the calculation dialogue. At the end of the dialogue, the result is displayed and you can accept the values.

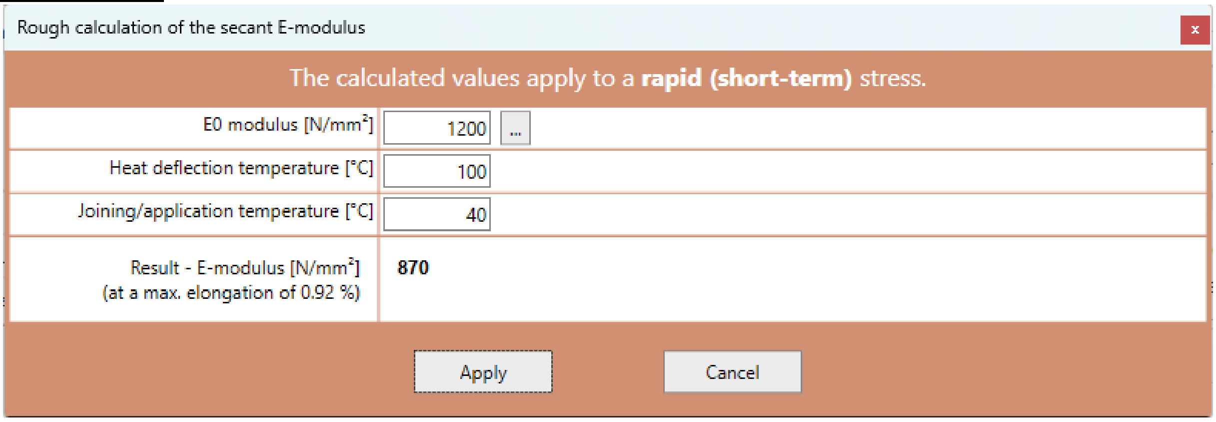
The calculation of the friction coefficient depends on the selected material combination. This means that you must first select the type of material combination **2** before you can call up the dialogue for the coefficient of friction.

The software usually remembers the last entries of the individual calculation modules (independent of the project). This means that when you call it up again, the last data entered is still contained. This also applies if you exit the software, restart it or edit a new project.

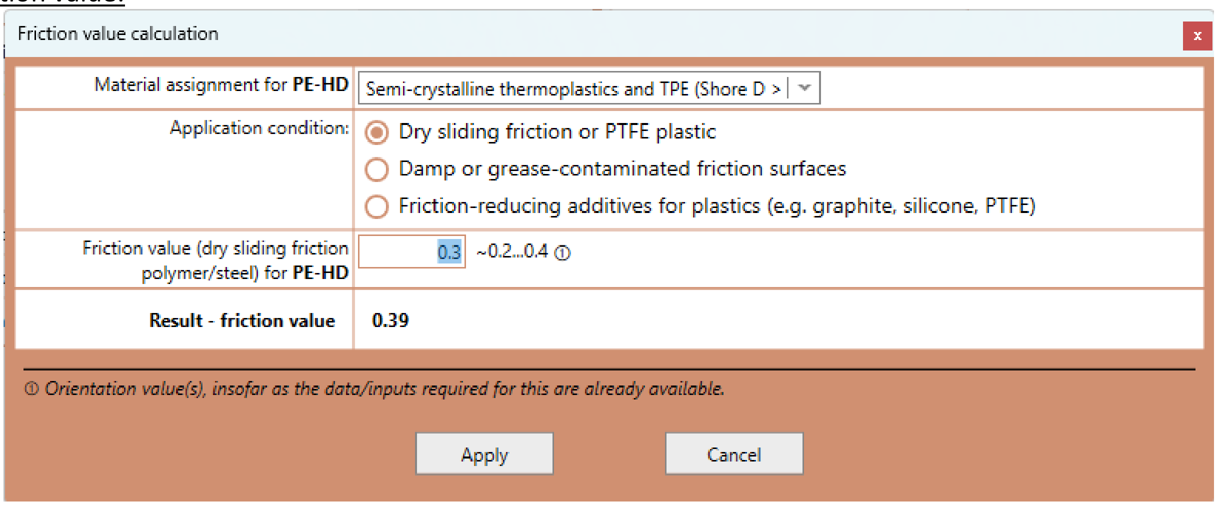
Notes on the calculation of the **secant E-modulus**:

- For the rough calculation of the **secant E-modulus**, the max. elongation is required. This in turn requires that the corresponding geometric dimensions have been entered beforehand. Depending on the connection type, further data may be required for the calculation of the max. elongation. A corresponding message may also be displayed.
- This also means that you should check the secant E-module again if you change the required data.

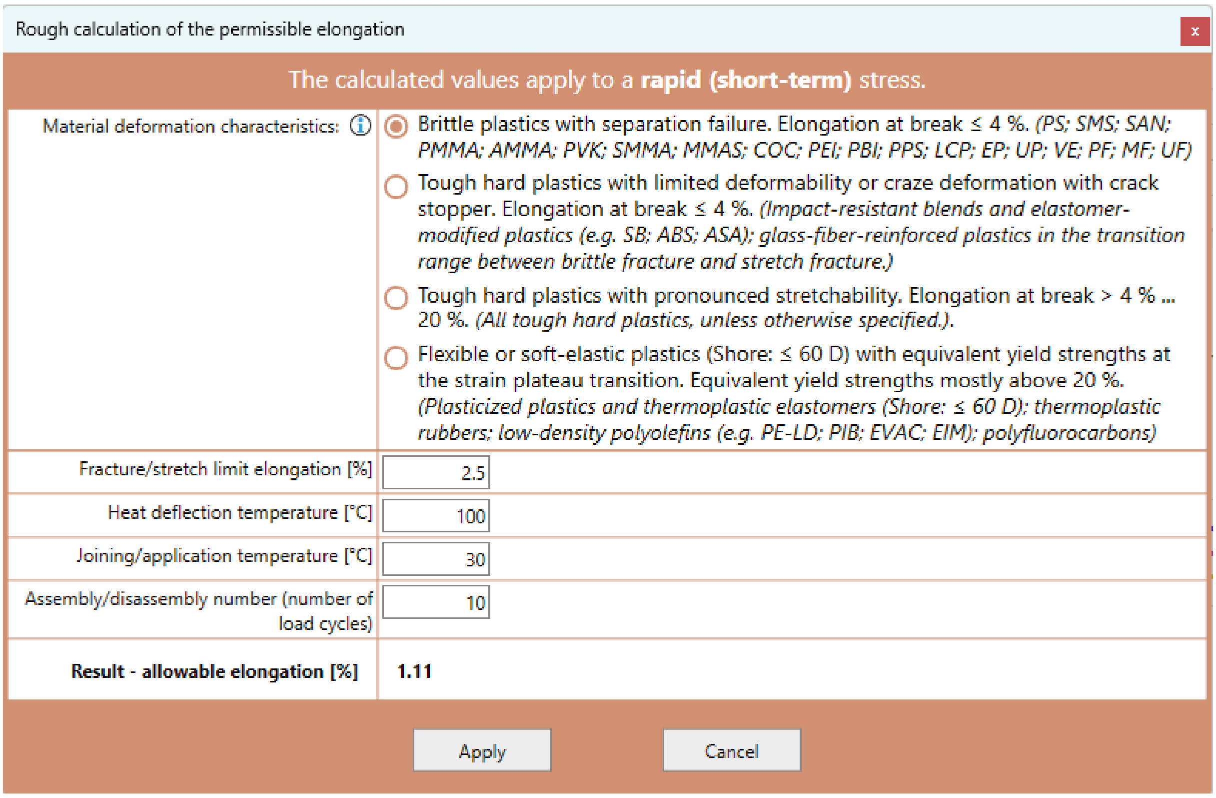
Secant E-module:



Friction value:



permitted Elongation:



special instructions

Note: The software is currently not (yet) able to check all your inputs for reasonableness. Please make sure your inputs are logical and correct to get the best possible results.

Ball snap connection
Shear force influence with short bending springs

Ball snap connection

For the insertion height *h*, a **minimum insertion height** is also calculated on the basis of the **ball diameter** and the **permissible elongation**. If the entered insertion height is less than the calculated minimum value, a corresponding message is displayed.

Shear force influence with short bending springs

In the case of very short bending springs, the shear force influence must be taken into account as a shear deformation component of the deflection.

A corresponding message appears in the software regarding a minimum length if this is not reached.

The cross-sectional area and the bending moment of inertia are the relevant parameters here, which you may have to modify.

Calculation of plastic spur gears

Operation

The basic operation is explained below.

Project management

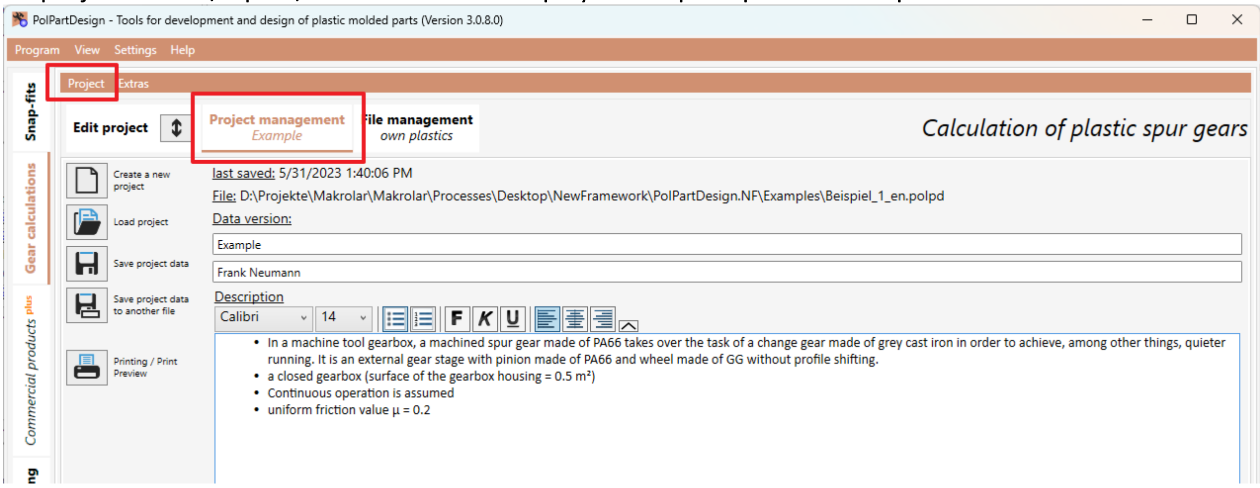
For project management, there is a corresponding menu in the main menu and a separate *Project Management* tab in the main window of the software.

The minimum requirement for saving a project is the *project name*. As soon as you have entered this, you can save the project via the corresponding button or the menu item. A dialogue opens in which you can specify the storage location and the file name.

Further project details are *editor* and *description*. All information can be added and edited later.

The *description* can be formatted according to your wishes by marking the desired text. Then a context menu opens with the corresponding format options.

All project details/inputs/decisions can be displayed in a print preview and printed out.



Furthermore, via the corresponding buttons/menu items you can:

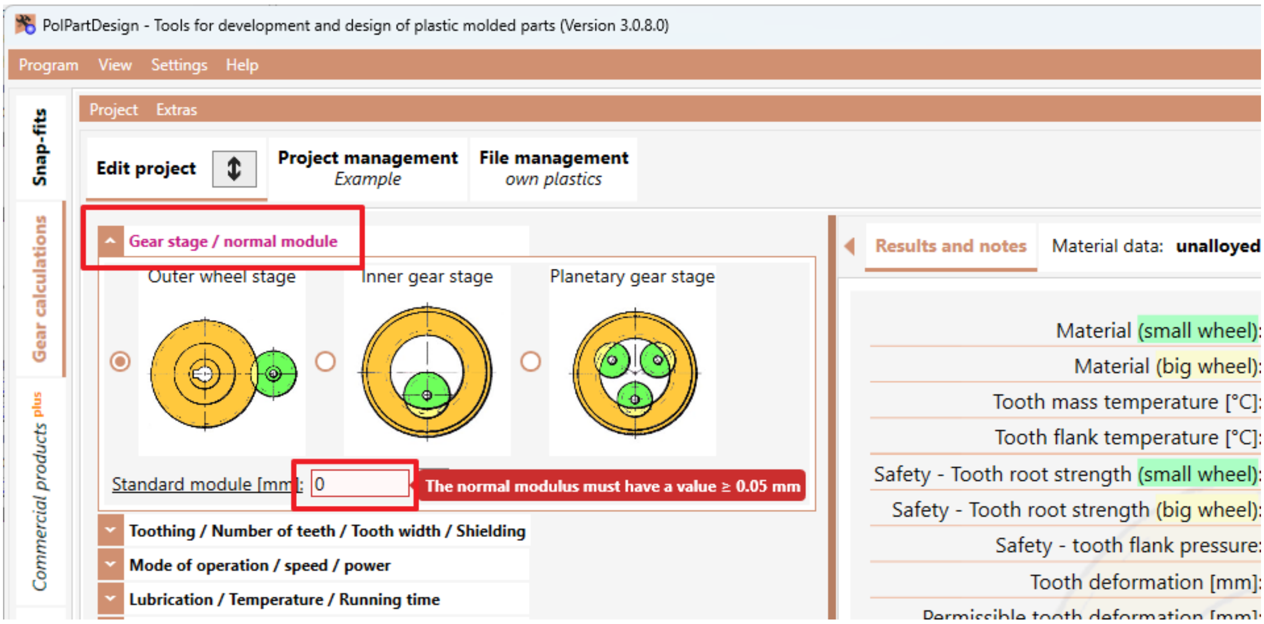
- create a *new project* (your previous inputs will be lost)
- *load* an existing project from a file (your previous inputs will be lost)
- *save* the *project* in a new/other file

Edit project

The various inputs and decisions are logically grouped. These are arranged in individual tabs. The tabs can be opened and closed individually/together.

If all inputs per tab are complete and correct, the heading of the tab appears in **black text colour**. As long as inputs/decisions are still missing, the **text colour** is **red**.

In addition, in the case of input fields, a note text may be displayed immediately next to it describing the error in more detail.



We recommend that you go through the inputs from "top" to "bottom", as certain intermediate results depend on previously made inputs/decisions.

As soon as all inputs have been made, the results are displayed on the right. Now you can change any inputs/decisions and immediately evaluate the resulting effects.

Gear stage / normal module

- select the gear stage
- if necessary, enter the number of pinions (planetary gear stage)
- enter the normal module or select it with the help of the *preferred series*

(normal) module m:

m = pitch circle diameter *d* divided by the number of teeth *z*

$$m = \frac{d}{z}$$

Normal modulus is the modulus in the normal section (a surface of the toothing perpendicular to the flank lines). The normal section surface is spatially curved.

Only gears of the same module can be combined. To simplify the selection of matching gears and to be able to use standardised tools, DIN 780 defines preferred series.

Notes on the TRIAL version:

- When selecting the gear stage "*planetary gear stage*", the number of pinions is preset at 4 and cannot be changed.

Toothing / Number of teeth / Tooth width / Shielding

- select the type of gearing
- if necessary, enter the helix angle (helical gearing).

- enter the number of teeth and the tooth width for the small and large wheel. The minimum number of teeth is 14.
- if the normal module has already been entered beforehand, the pitch circle diameters are calculated and displayed immediately.
- select the type of gear shield
- enter the surface of the gearbox housing for closed or partially closed gears.

Gearbox shielding against the free environment is understood to include both special gearbox enclosures (gearbox housings) and any form of structurally specified shells, walls, covers, etc.

If you change the number of teeth on one gear, the speed of the other gear is recalculated (as soon as all other required inputs/decisions have been made).

Notes on the TRIAL version:

- Number of teeth only permissible in the range 50...70
- for helical gearing only 11° can be specified as helix angle

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Mode of operation / speed / power

- select the mode of operation of the gearbox
- if you have selected your own *application factor*, you must also enter the factor
- specify whether the *torque* or the *rated gearbox power* is specified
- either enter the torque for one of the two gears or enter the nominal gearbox power. The other values are calculated immediately (provided all other minimum specifications are available).

If you change the value of the torque, the rated gear power and the torque of the other gear are calculated.

If you change the value for the gearbox rating, the torques of the gears are recalculated.

Notes on the TRIAL version:

- the own *application factor* (mode of operation of the gearbox) cannot be used
- Speeds are only supported in the range of 500 ... 1400 rpm are supported
- The gearbox power rating cannot be edited

Lubrication / Temperature / Running time

- select the type of lubrication
- Enter the ambient temperature of the gearbox.
- select *continuous operation* or *intermittent operation* for the gearbox running time.
- in the case of *intermittent operation*, you must also enter the *relative duty cycle*. *The relative duty cycle indicates the ratio of the operating time to the idle time*.
- enter the *total running time* of the gearbox. The *number of load cycles of the pinion* is calculated immediately (provided all other necessary entries/decisions have been made).

Gearbox running time:

- For intermittent operation of the gearboxes, the setting of the thermal equilibrium for tooth mass and tooth flank temperature depends on the gearbox running time per running cycle. For running times over 80 min, continuous operation can be assumed. Otherwise, the duty cycle per running cycle determines the level of achievable tooth temperatures.
- Dynamic additional forces from the mode of operation of the gear (drive and driven machines and devices) are taken into account in the gear calculation by the application factor according to DIN 3990 part 1. These can be estimated values or specified operating values.

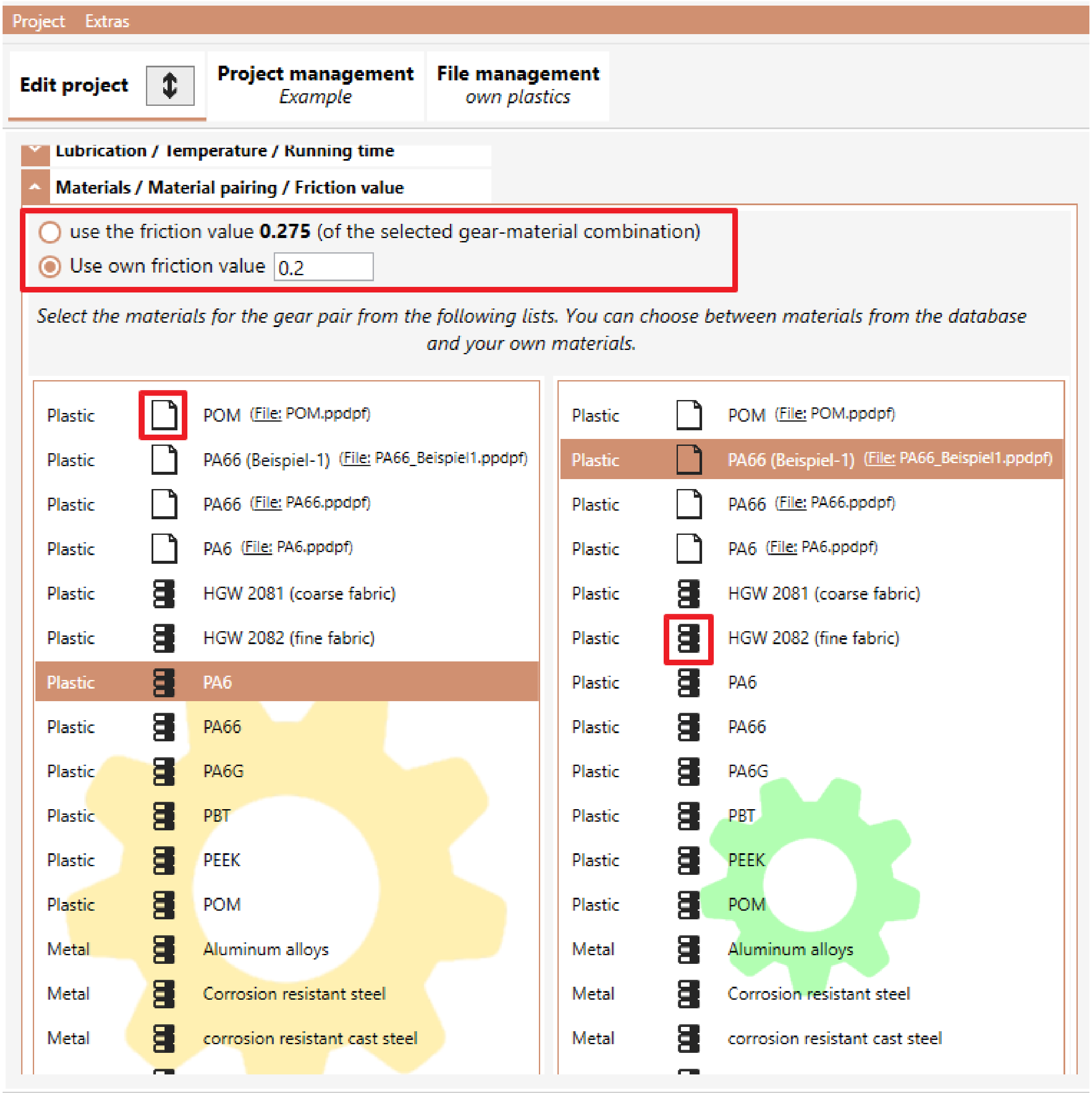
Notes on the TRIAL version:

- Only *single grease lubrication* is available for selection as the *type of lubrication*. As a result, and in this case, the calculated friction value is independent of the selected materials of the tooth pairing (see also Materials / Material pairing).

Materials / Material pairing / Friction value

- Select the corresponding materials for the gear pairing here. As far as possible, the friction value for the selected pairing is calculated and displayed.
- If you have selected *Use own friction value*, you must also enter this. This will then be used instead of the friction value of the gear pairing for the further calculation.

The lists of selectable materials contain both metals and plastics. For the calculation, **at least one material** of the gear pair must be a **plastic**.



<u>The symbols in the first column of the lists have the following meaning</u>:

- it is a material whose data is contained in the supplied local database
- it is a plastic that has been defined by you and saved as a file (see also: file management (own plastics))

<u>Note</u>: For **metals**, **only the data** from the supplied **local database** can currently be used. Own data are currently not usable.

Notes on the TRIAL version:

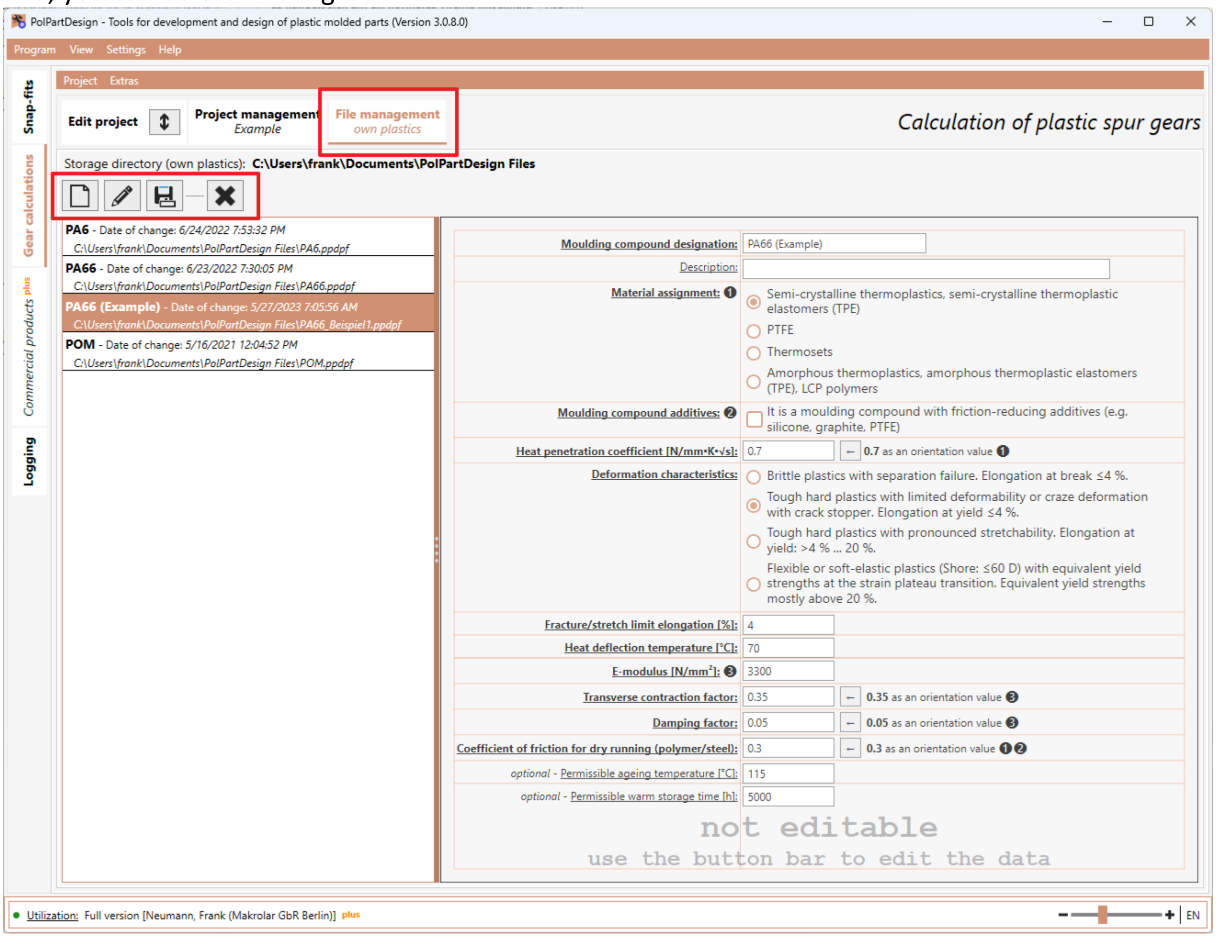
- only the determined friction values of the selected gear pairing can be used. It is not possible to enter your own friction value.
- Since only single-grease lubrication can be selected in the TRIAL version, the determined friction value does not change either. No matter which gear pairing is selected (see also Lubrication / Temperature / Running time)

File management (own plastics)

The software is delivered with a local database. This database contains metals and plastics (common for plastic gears or gear wheels).

With the additional file management you can also define your own plastic materials and use them for the subsequent calculations.

- The data for a user-defined plastic is managed in one file each.
- You can add new files
- You can edit existing files/data subsequently
- you can copy existing files (e.g. as a template) for another plastic
- and, you can delete existing files

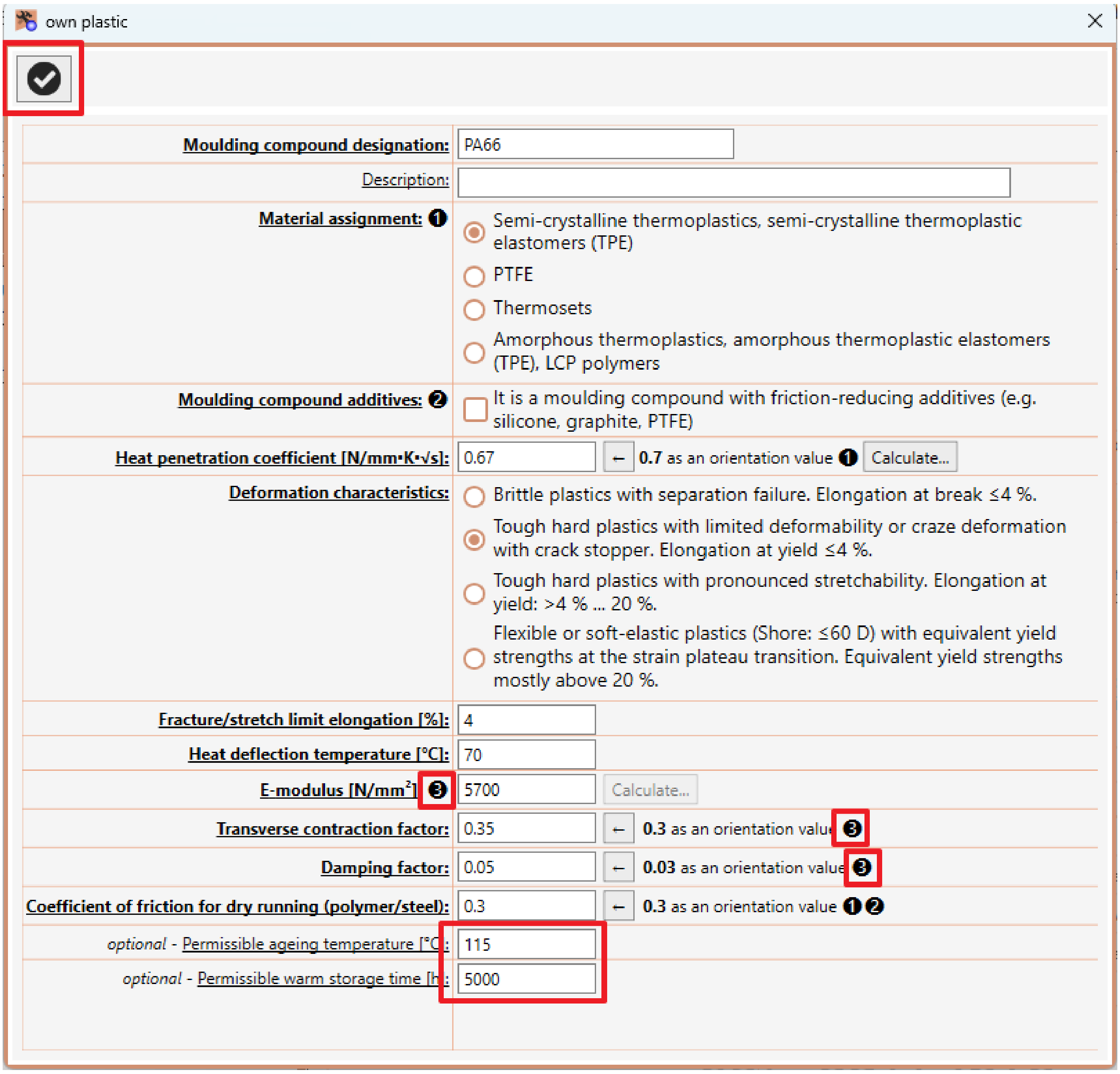


- On the left is the list of plastics with designation, date of last saving and the storage location.
- On the right, the data of the currently selected entry is displayed.
- Using the buttons (above the list), the plastics can be edited accordingly.

Via the *main menu/Settings/Options* you can specify where your files should be saved. When the software is started, the files are read from the specified directory and automatically transferred to the file management list and the material selection lists (gear pairing).

Edit

After selecting a plastic entry and clicking the Edit or New button, the following window opens.



If it is an existing plastic, the previous data is displayed and can be changed. In the case of a new plastic, all inputs are usually "empty".

For certain inputs, orientation values are determined and displayed. The orientation values may depend on other inputs/decisions. These dependencies are indicated by corresponding numerical symbols. Here, for example, ❸ means that the orientation value for the *transverse contraction factor* and for the *damping factor* is dependent on the *E-modulus*.

As soon as all required inputs are correct and complete, the button (top left) is activated and the plastic can be accepted. If it is a new plastic, the file dialogue for saving the plastic in a file is opened.

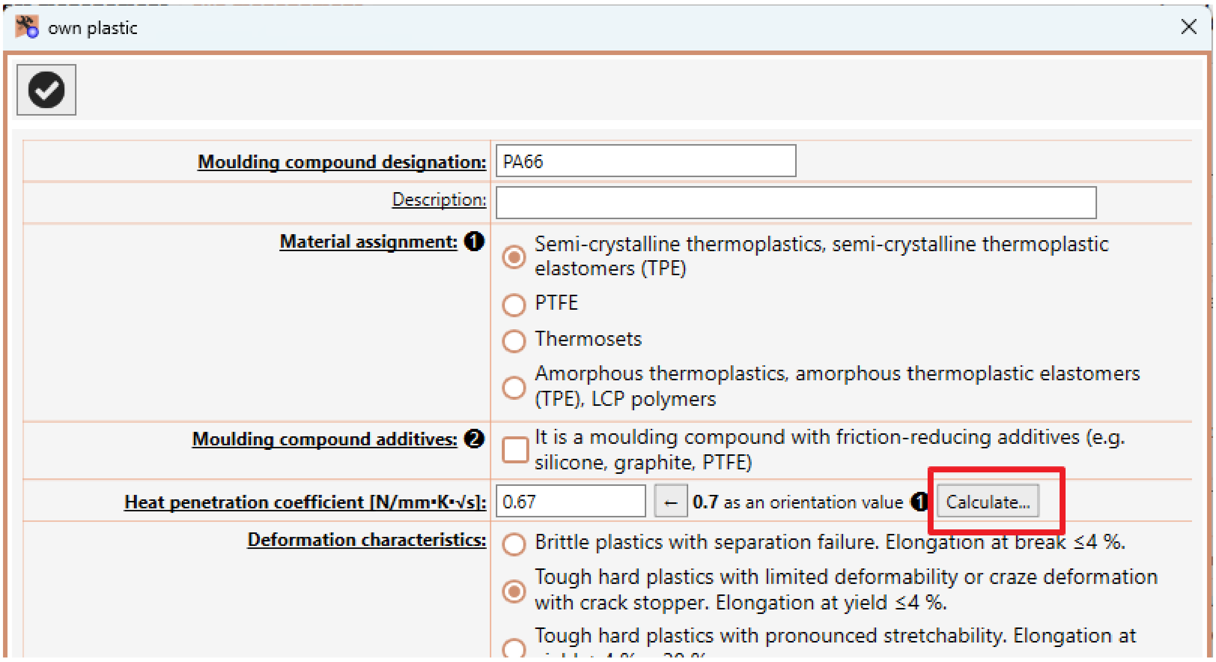
The values for *permissible ageing temperature* and *permissible warm storage time* are optional and are needed to calculate the permissible tooth flank temperature.

To determine the values for *permissible ageing temperature* and *permissible warm storage time*, you can use our PolSelec software, for example.

Calculation of the heat penetration coefficient

In addition to the corresponding orientation value, you can also calculate the heat penetration coefficient.

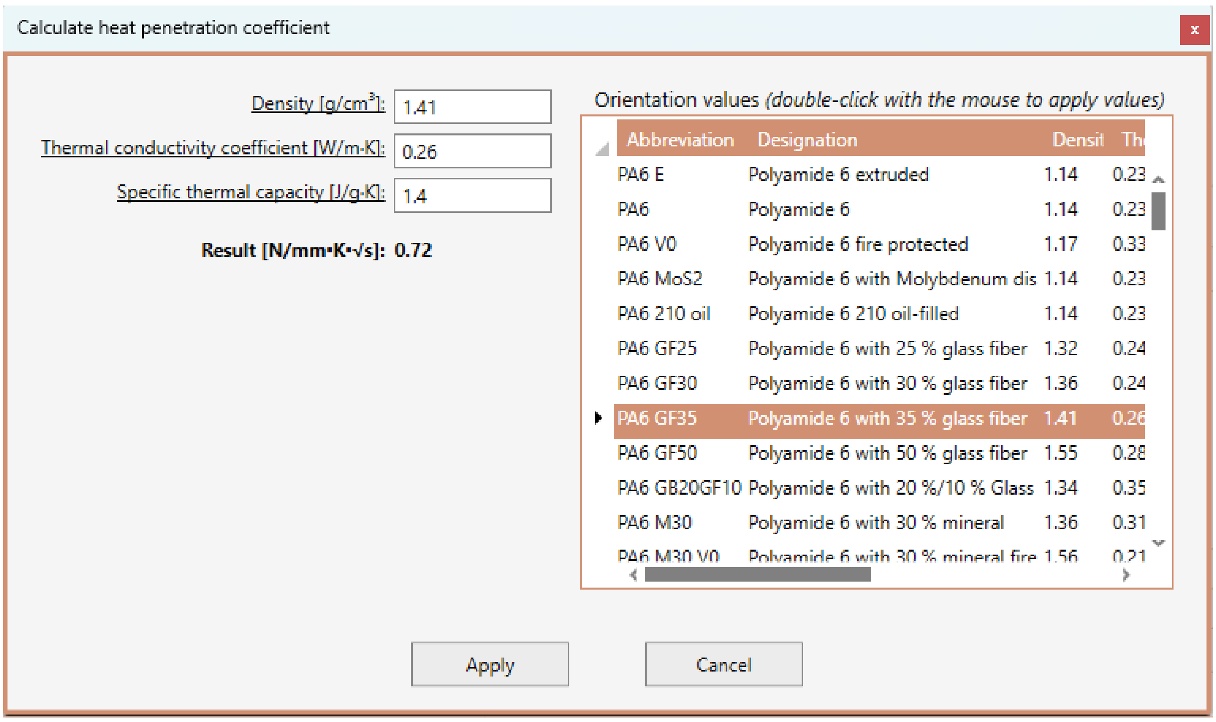
To do this, click on the [*Calculate*] button on the right.



The following window opens. Enter the data for *density*, *thermal conductivity* and *specific heat capacity* here. The result is displayed immediately below.

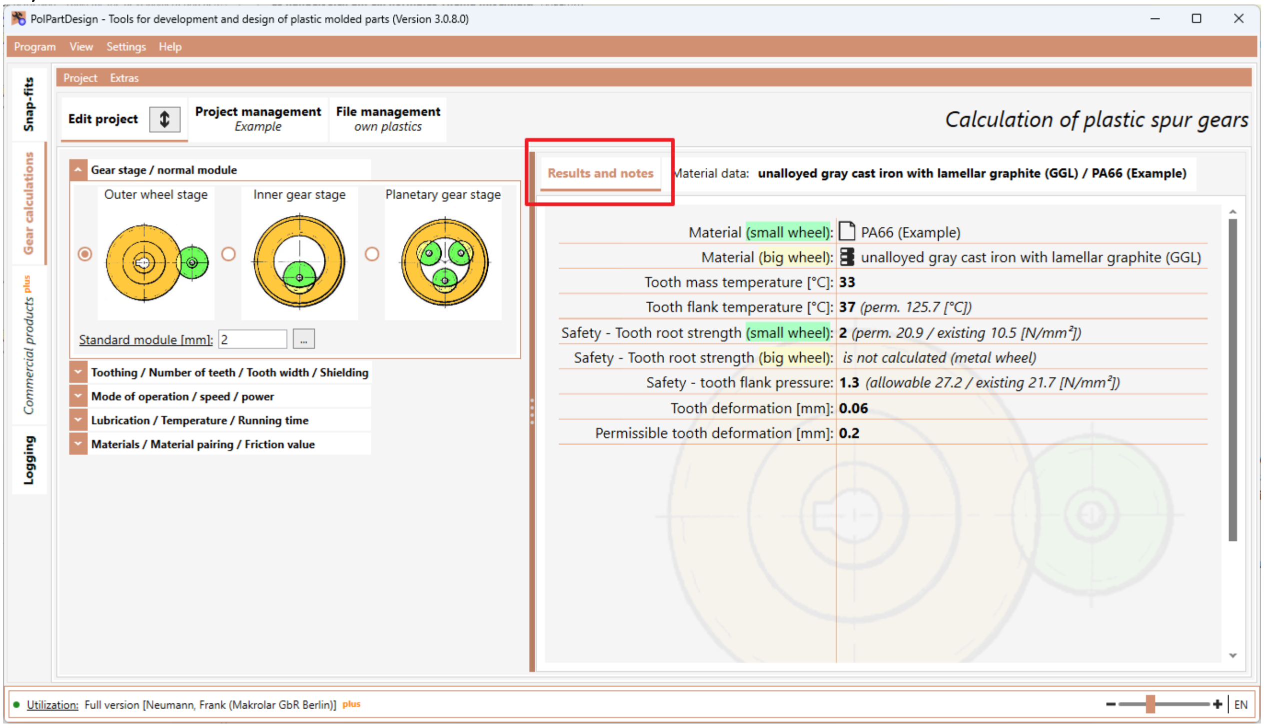
In the list (right), approx. 150 materials are listed with the required data (orientation values). Double-click with the mouse to transfer the data for a material into the input fields. The list can be sorted in ascending and descending order per column.

If you close the window via the [*Apply*] button, the result is transferred to the corresponding input field (see above).



Results

As soon as all inputs/decisions are available, the results are displayed immediately. **Any** subsequent **changes/precisions** to the inputs and decisions will **immediately update the results** (if your changes do so).



- The calculation of the tooth mass temperature is based on a heat balance from friction losses and mechanical damping losses in connection with a specified heat transfer model.
- The tooth flank temperature is determined with a modified intergral temperature method according to DIN 3390. Continuous heat dissipation through oil with oil lubrication is not taken into account.
- The gear calculations of the software are not identical with the content and scope of the withdrawn VDI 2545. In particular, the tooth temperature calculations **are not based** on the empirical relationships of *Hachmann/Strickle/Erhard*.
- The safety - tooth root strength is not calculated/displayed if the corresponding wheel is a metal wheel.

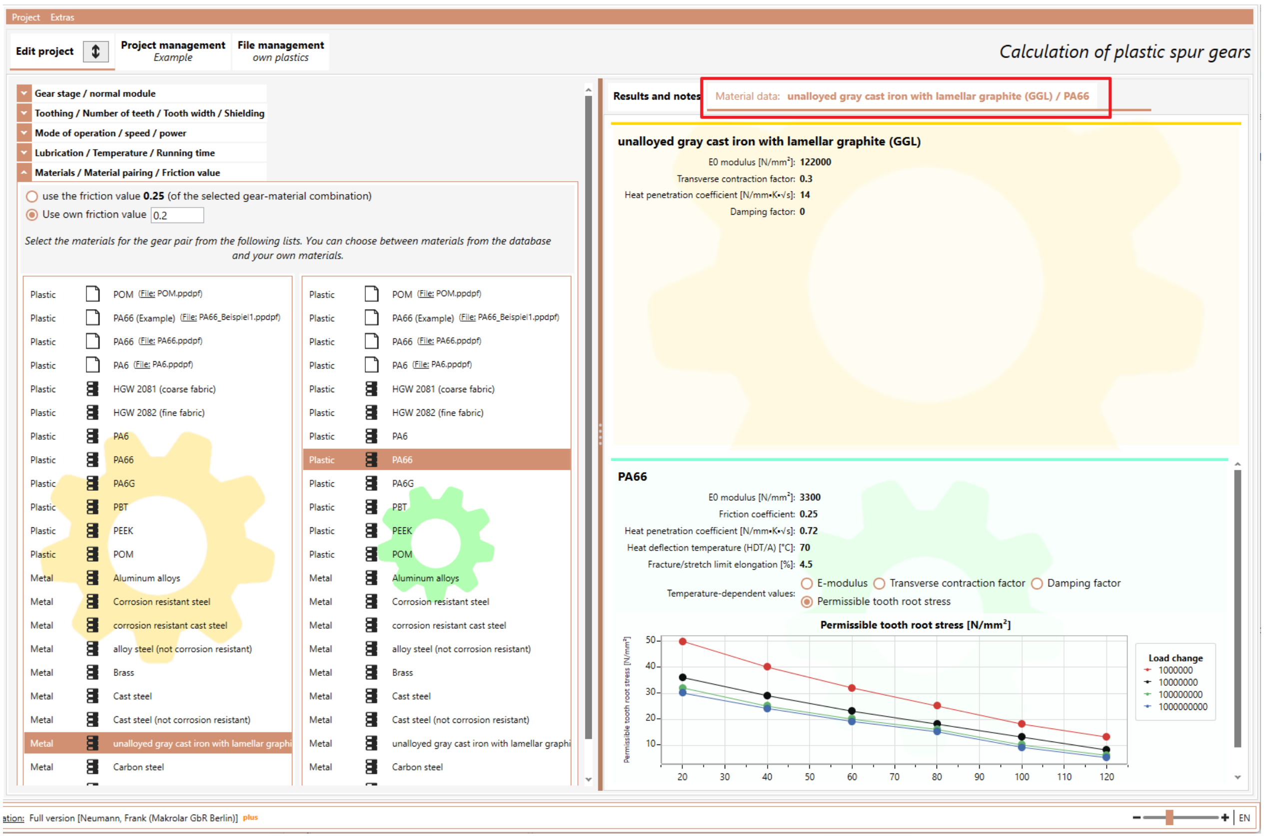
To calculate the permissible tooth flank temperature, a permissible warm storage time t_{zul} of **5000 h** is used (for the plastics in the database supplied). When using your own plastics data (files), you must have entered the values for *permissible ageing temperature* and *permissible warm storage time* (use your own plastics data).

Database data

The software is delivered with a local database containing common materials for plastic gear and gearwheel calculations. The plastic data of the local database are orientation or average values and can be used for calculation without further specification.

Exact plastic property values depend, among other things, on corresponding material modifications (auxiliary, filling and reinforcing materials). To take this into account accordingly, you have the option of defining your own plastics and specifying their properties (see also file management (own plastics)).

For the materials in the local database, there are corresponding displays to show the saved property values. You will find the display directly next to the *Results/Notes* tab. The tab is displayed if at least one material of the gear pair is a material from the local database.



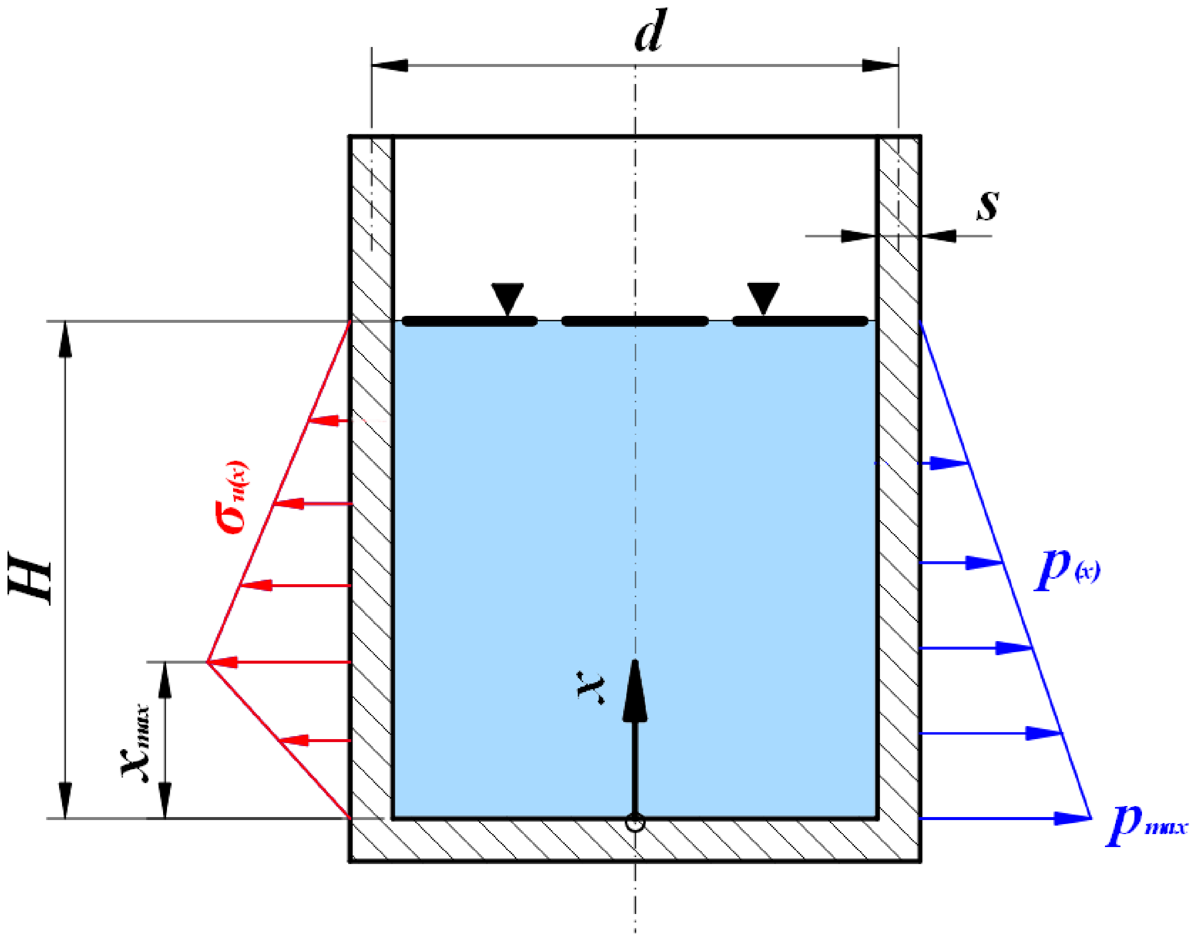
To calculate the permissible tooth flank temperature, a permissible warm storage time t_{zul} of **5000 h** is used (for the **plastics in the database** supplied). For your own plastics, you must explicitly specify this value.

Calculation of plastic tanks

For the loading of cylindrical liquid tanks made of plastics, a distinction is made between the following types of time progression during the application time:

- Continuous constant (static) load with possible variation of the liquid temperature
- Interrupted (intermittent) loading through the same or different load cycles

<u>Principle sketch:</u>



<u>The following requirements must be met:</u>

- the upper edge is free and the lower edge is clamped to the base so that it cannot move
- the (constant) tank wall thickness s is small compared to the tank diameter d (membrane)
- the tank wall consists of isotropic or orthotropic materials

The required material data is determined from basic data according to an internal program method and recommended to the user as orientation values.

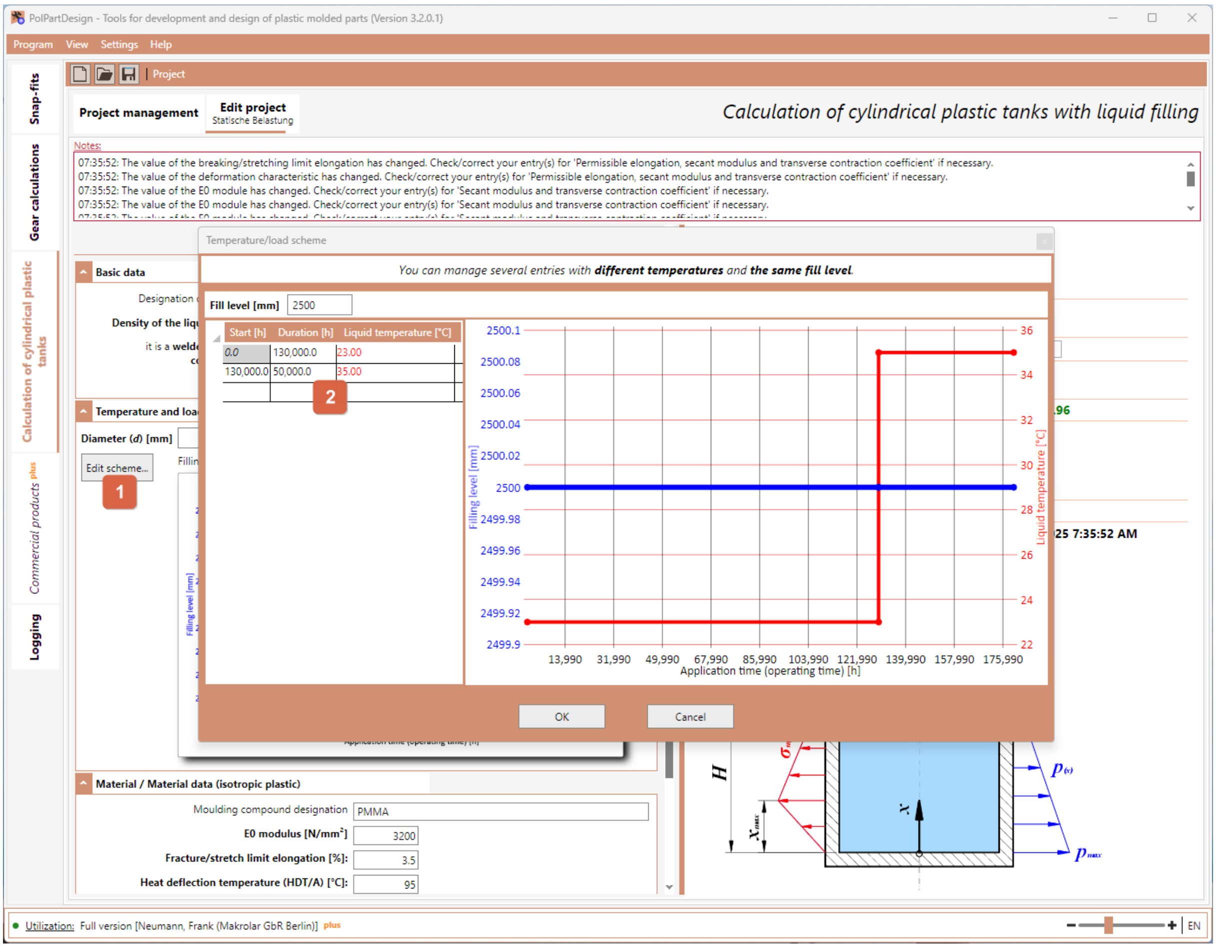
<u>Note:</u>

If it is a **welded or bonded construction**, **you must take** a corresponding **reduction in strength** into account. We recommend that you reduce the permissible elongation accordingly.

Static load

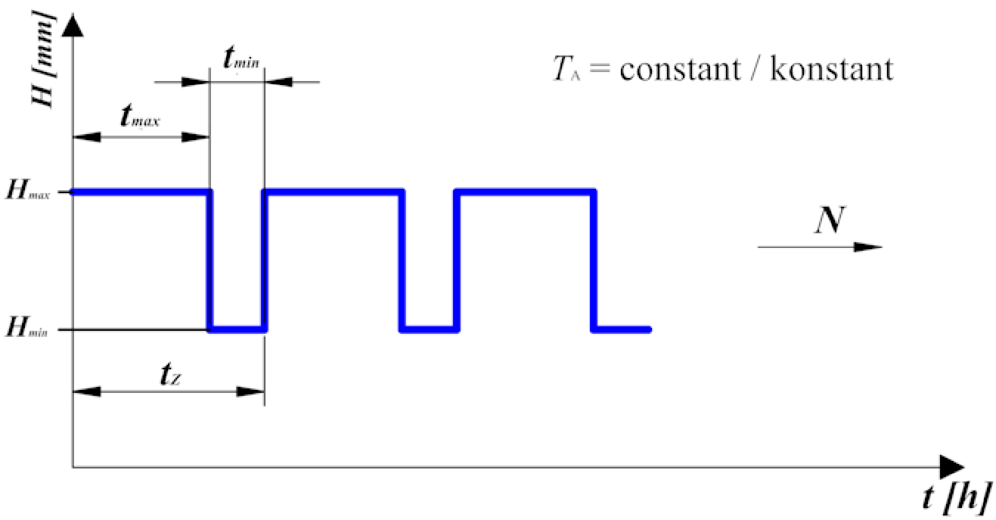
Continuous constant (static) load (constant fill level) with possible variation of the liquid temperature.

- In addition to the basic data and material data, the load curve must be input
- For different application/liquid temperatures, you can record individual partial cycles (with duration and liquid temperature) 1 / 2.



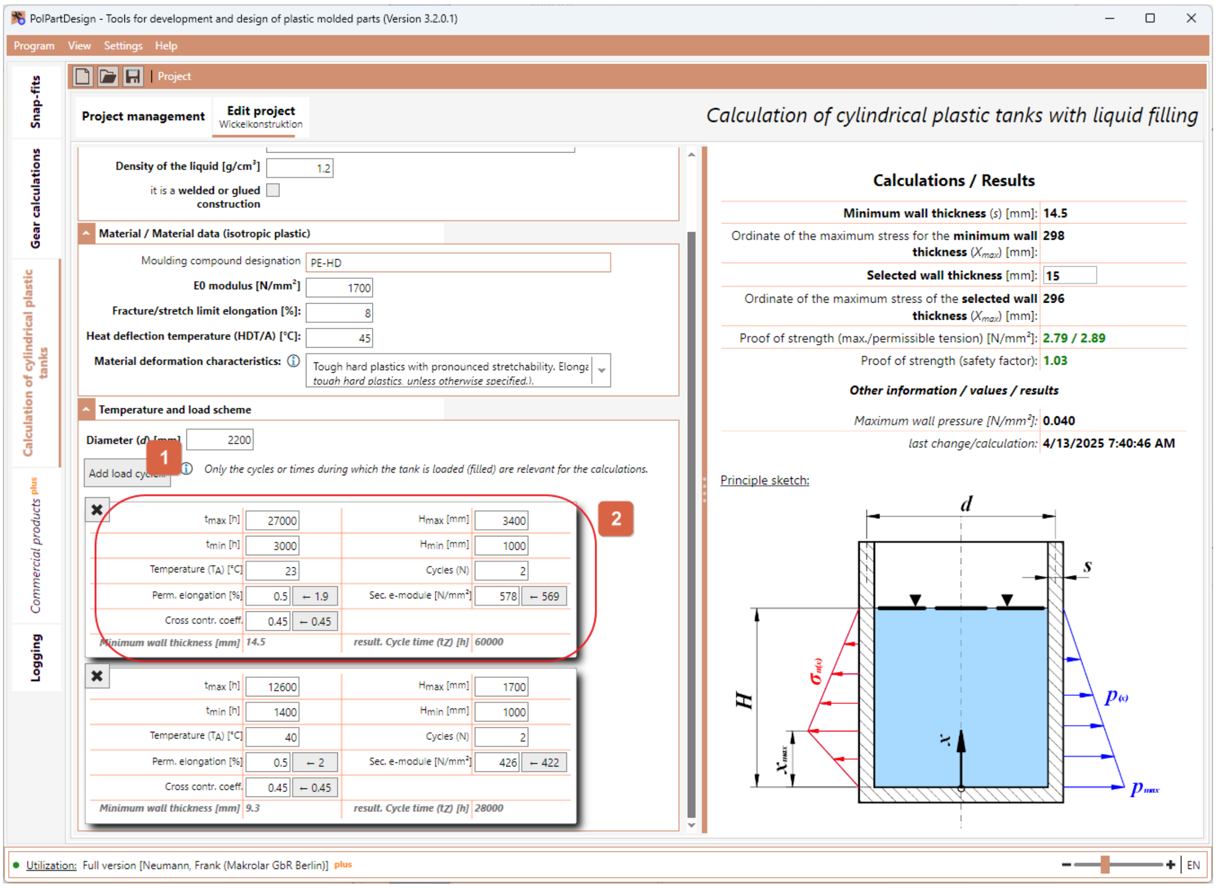
Intermittent load

- For intermittent tank loading, load cycles must be defined for the total operating time 1 / 2



- Inputs are **per load cycle**:
  - maximum fill level
  - minimum fill level
  - proportion of time with maximum load (max. fill level)
  - proportion of time with minimum load (min. fill level)

  - the number of cycles
  - Liquid/application temperature
- for each load cycle, the specific material data are calculated as orientation values and can be adopted
- the individual minimum wall thickness is calculated for each load cycle
- the **load cycle with the greatest minimum wall thickness** is decisive **for the subsequent calculations**



Strength reductions

If there is a risk of stress cracks or similar reductions in strength, the following guidelines for determining the permissible elongation (ε_{zul}) for tank materials (plastics) should be observed:

$$\varepsilon_{zul} \approx \frac{\varepsilon_{krit}}{3}$$

Reference value ranges of critical strains from tests in an air environment

The following range specifications of the critical elongation (ε_{krit}) result from material-structural influences and from the physical measuring principle of the test methods. They should be used by the user for design calculations in terms of the usual safety assessment for different requirements and risks.

Critical strains **are not** polymer-specific **material parameters**:

Polymers	**Operating temperature**	**ε_{krit} [%]**	**Examples**
Amorphous thermoplastics (except PS)	less than T_g	0.6 to 0.9	PC, ABS, SAN, PVC-U, PMMA, SB, PSU, PESU, (PC+ABS), (PPE+SB)
Polystyrene	less than T_g	0.2 to 0.3	PS
Semi-crystalline thermoplastics	less than T_g	0.4 to 0.8	PA6 (d), PA66 (d), PA610 (t), PEEK
	more than T_g	1.5 to 2.5	PA6 (nh), PA66 (nh), PA610 (nh), PP, PE-HD, POM
Glass fiber reinforced thermoplastics (over 15% GF)	less than T_g	0.2 to 0.3	all thermoplastics
	more than T_g	0.3 to 0.5	
Glass mat-reinforced thermosets (over 10% GM)	–	0.3 to 0.5	UP, EP
Thermoset press and injection molding materials	–	(0.2 to 0.3) • ε_B	All types according to DIN EN ISO 14526 to 14530 (PMC) and according to DIN EN 14598 (BMC, SMC)

- T_g: Glass temperature of the amorphous polymer phase
- ε_B: Elongation at break according to DIN EN ISO 527
- (d): dry
- (nh): normal humidity