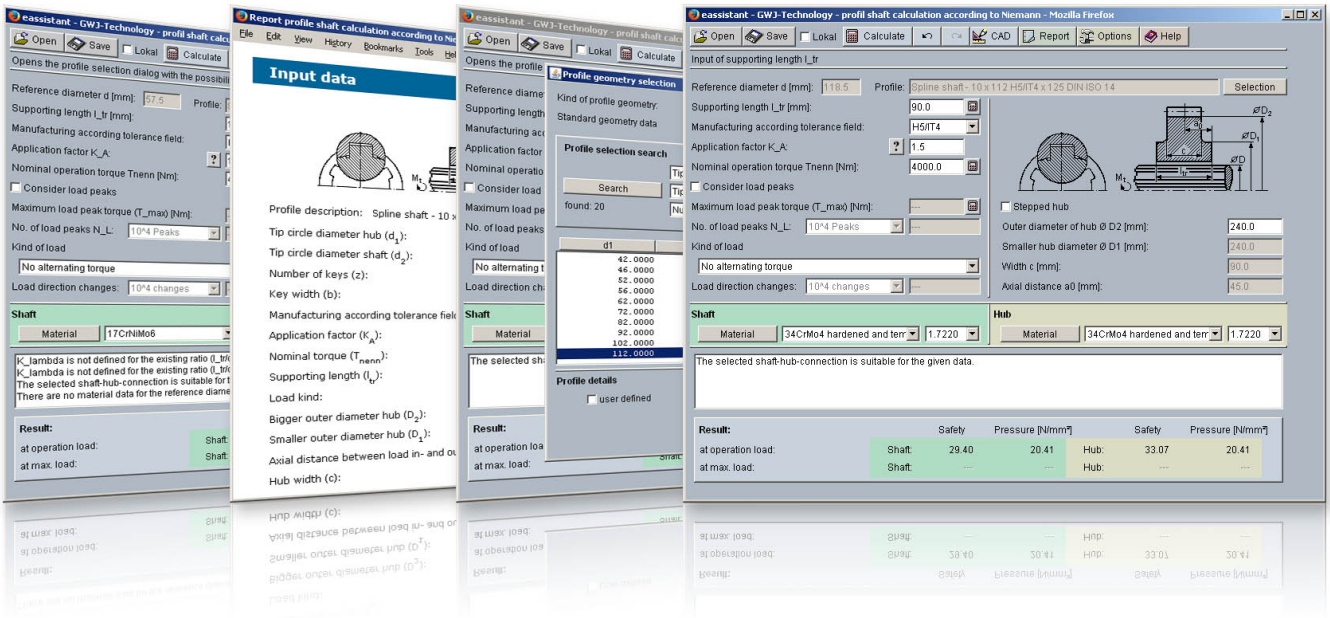
Calculation Example

Splined Shaft According to Niemann



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Contents

0.1 Calculation Example: Splined Shaft for Lifting Gear

We have prepared the following example to guide you through the calculation module and to show you some general functions. This calculation example is based on: G. Niemann, H. Winter, B.-R. Hoehn: Maschinenelemente Band I: Konstruktion von Verbindungen, Lagern, Wellen. Springer Verlag, 3rd Edition, 2001: p. 857 Example 4: Splined shaft for lifting gear.

0.1.1 Start the Calculation Module

Please login with your user name and your password. To start the calculation module for splined shafts, please click the menu item 'Connections' on the left side and then select 'Splined shaft'.

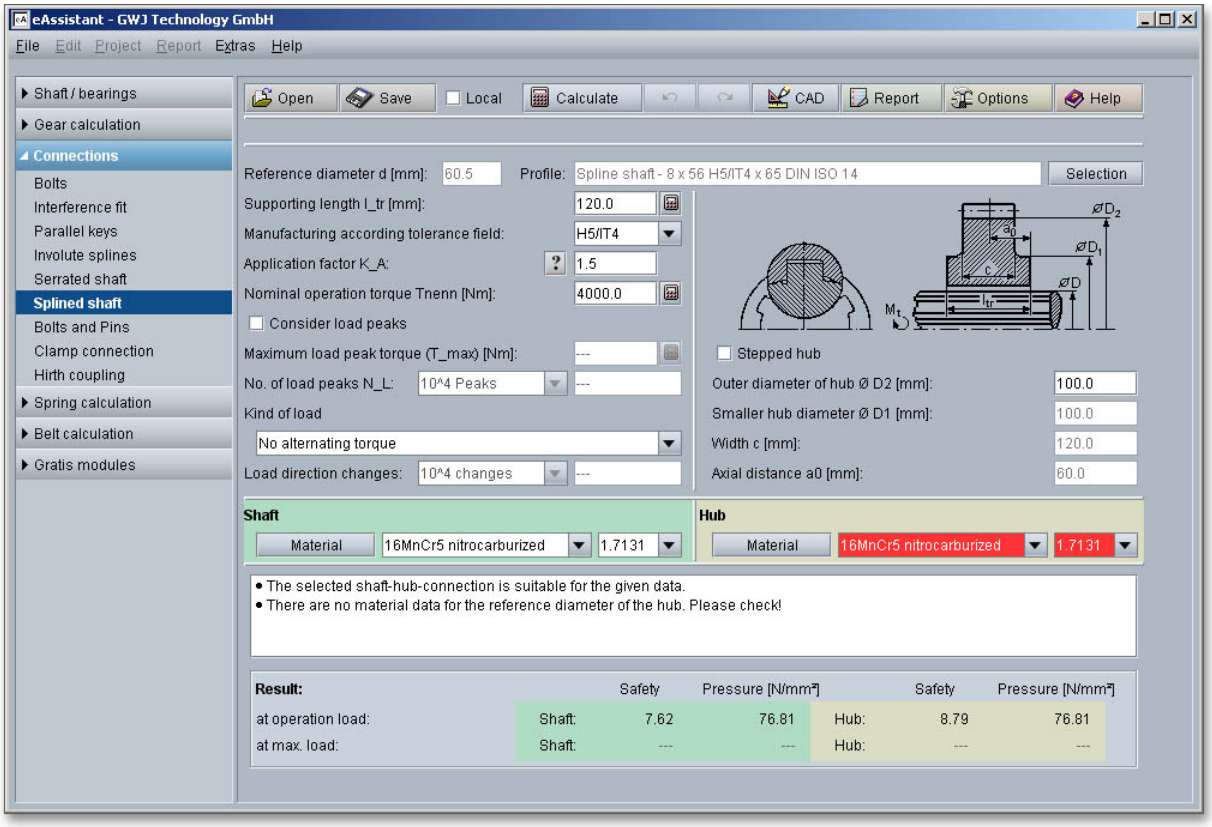

Figure 1: Calculation module

0.1.2 Input Values

A splined shaft connection with a splined shaft according to DIN ISO 14 is given. The safety against pressure is required. For our calculation example the following input values are given:

Diameter d_1 = 32 mm
Diameter d_2 = 38 mm
Number of keys = 8
Key width = 6
Supporting length l_{tr} = 40 mm
Manufacturing according to tolerance field = H7/IT7
Application factor = 1
Nominal operation torque T_{nenn} = 2400 Nm
Maximum load peak torque T_{max} = 2400 Nm with number of load peaks >10^7
No alternating torque

Outer diameter of hub $D_2 = 45$ mm
Material shaft = C45 hardened and tempered
Material hub = C45 hardened and tempered

0.1.3 The Calculation

Profile Geometry Selection

In order to find the right profile, click the button 'Selection'.

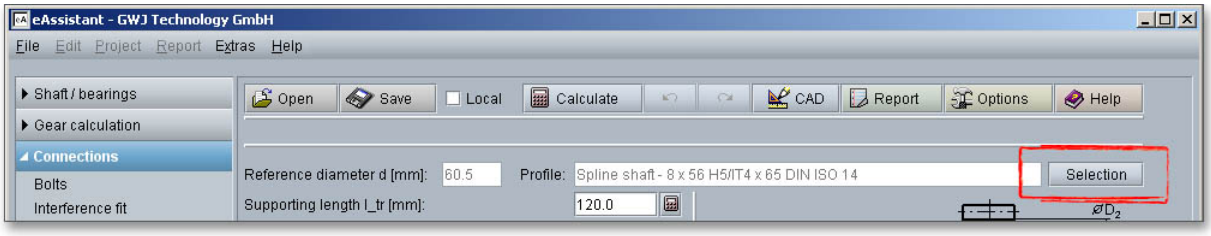

Figure 2: 'Selection' button

Select from the listbox 'Standard geometry data' the splined shaft profile according to DIN ISO 14 medium series.

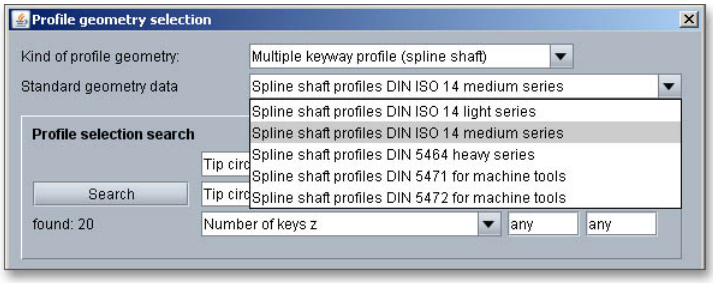

Figure 3: Profile geometry selection

You can narrow your search by entering certain parameters in order to find the right profile quicker. Just add the diameter d_1, the number of keys as well the key width. Click on the button 'Search'.

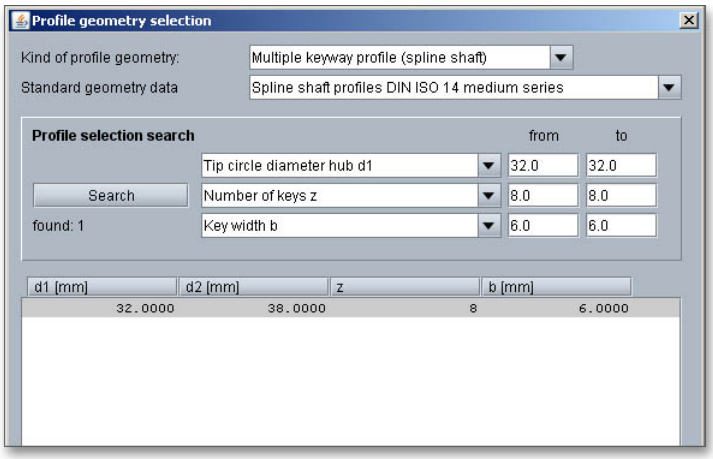

Figure 4: Refine the profile geometry selection

After clicking the button 'Search', only one profile remains. Please select the profile and click the button 'OK'.

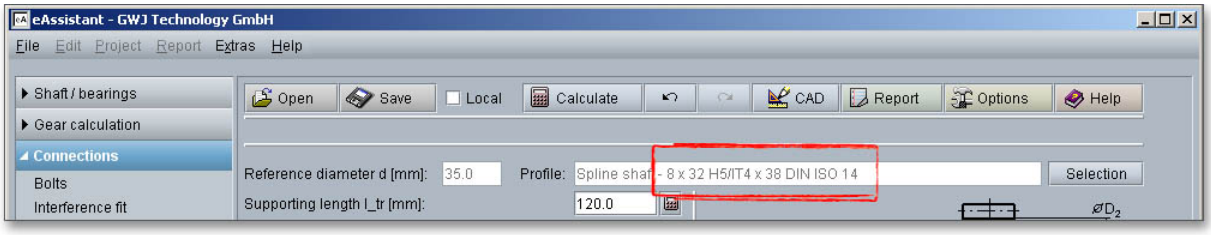

Figure 5: Selected profile

Enter 40 mm for the supporting length l_{tr}.

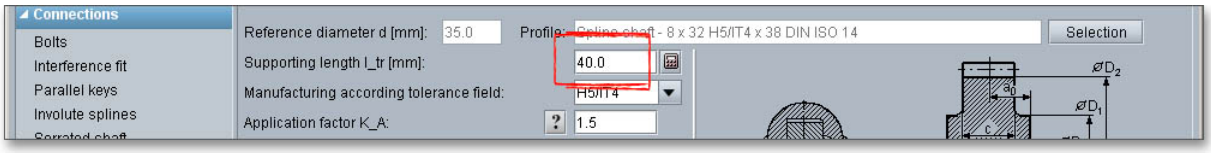

Figure 6: Supporting length

Tolerance Field

Click the listbox in order to choose the tolerance field H7/IT7.

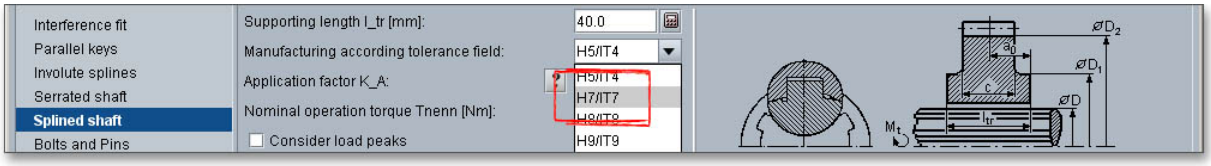

Figure 7: Tolerance selection

The field 'Profile' displays the previously selected tolerance field.

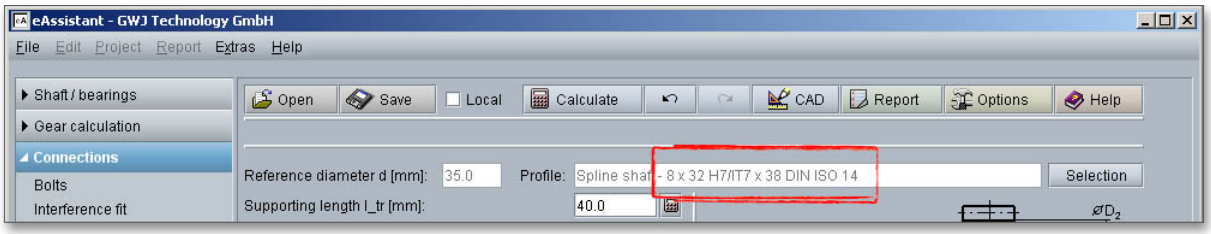

Figure 8: Tolerance field

Please add the application factor as well as the nominal operation factor T_{nenn}.

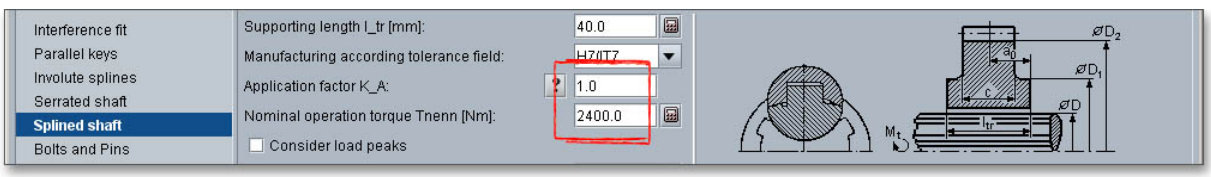

Figure 9: Application factor and nominal operation torque

Load Peaks

Activate the load peaks und enter 2400 for the maximum load peak torque T_{max}.

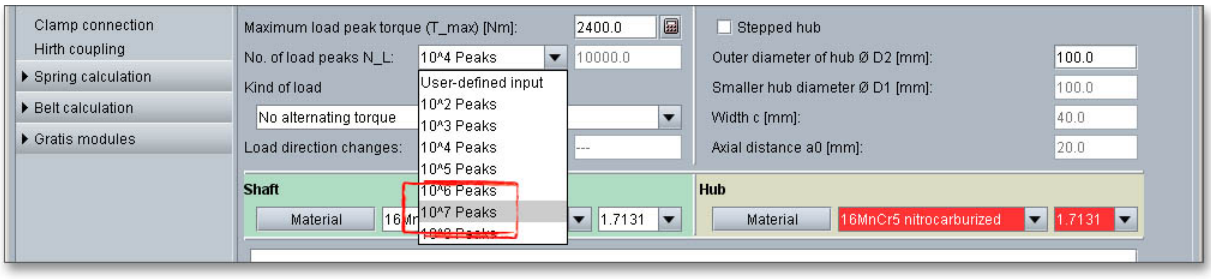

Figure 10: Load peaks and load peak torque T_{max}

Select the number of load peaks from the listbox.

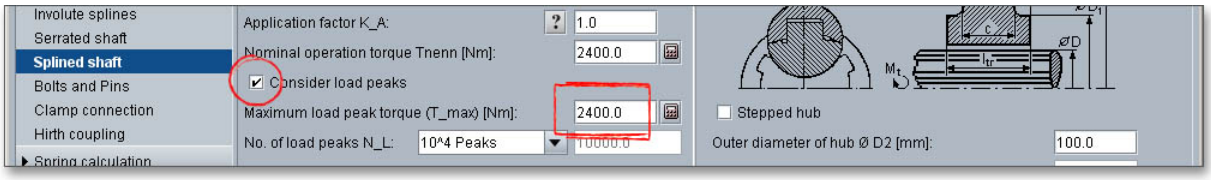

Figure 11: Number of load peaks

Kind of Load

There is no change in load direction, so enter the default setting 'No alternating torque' for the kind of load.

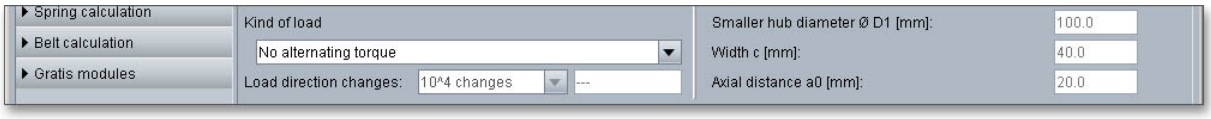

Figure 12: Kind of load

Enter the value 45 mm for the outer diameter of the hub.

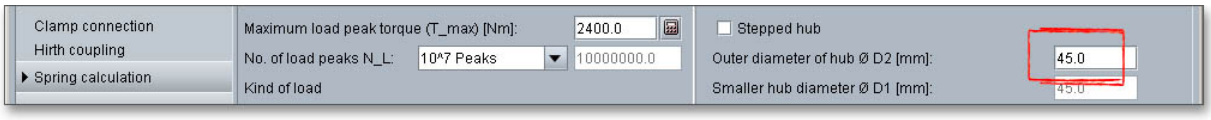

Figure 13: Outer diameter of hub

Material of Shaft and Hub

Select the material C45 hardened and tempered for the shaft.

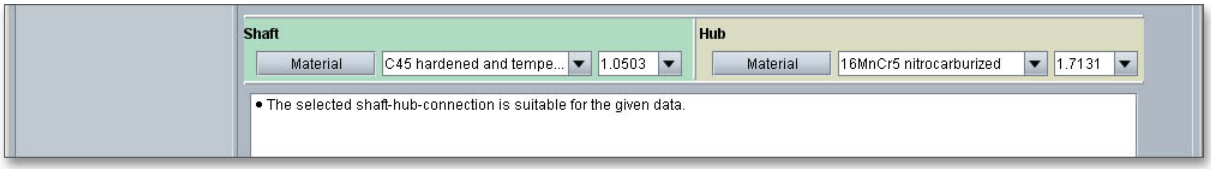

Figure 14: Material for the shaft

Hinweis: In case you need further information on the material, click on the button 'Material'.

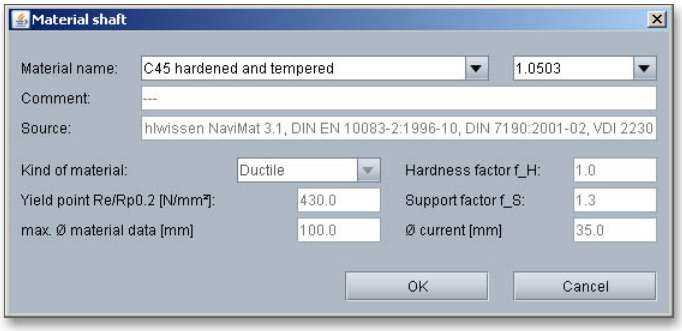

Figure 15: Material details

Select the hub material C45 hardened and tempered from the listbox.

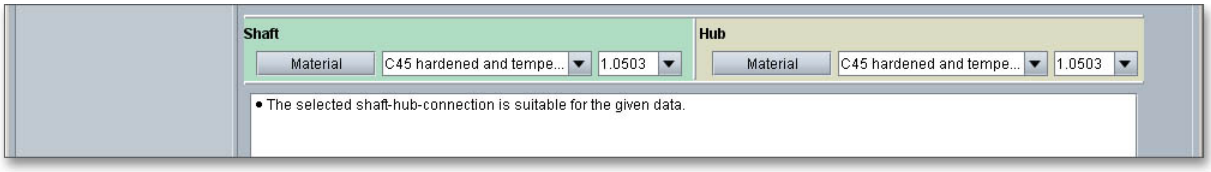

Figure 16: Material for the hub

0.1.4 Calculation Results

All results (safeties at operation load and maximum load, the pressures for shaft and hub) will be calculated during every input and will be displayed in the result panel. A recalculation occurs after every data input. Any changes that are made to the user interface take effect immediately.

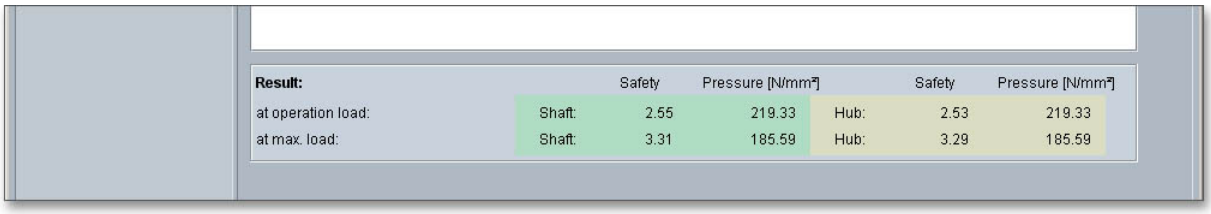

Figure 17: Calculation results

For our calculation example the splined shaft is sufficiently dimensioned. In addition, the message window contains the hint that this shaft-hub-connection is suitable and can be used.

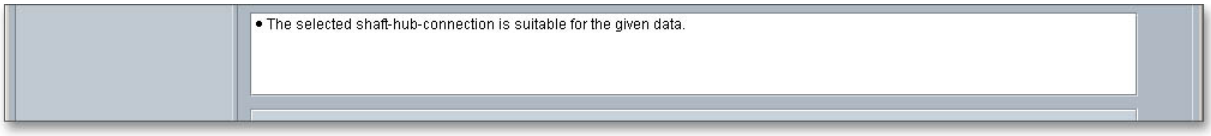

Figure 18: Message window

0.1.5 Documentation: Calculation Report

After the completion of your calculation, you can create a calculation report. Click on the 'Report' button. You can navigate through the report via the table of contents that provides links to the input values, results

and figures. This calculation report contains all input data, the calculation method as well as all detailed results. The report is available in HTML and PDF format. The calculation report saved in HTML format, can be opened in a web browser or in Word for Windows.

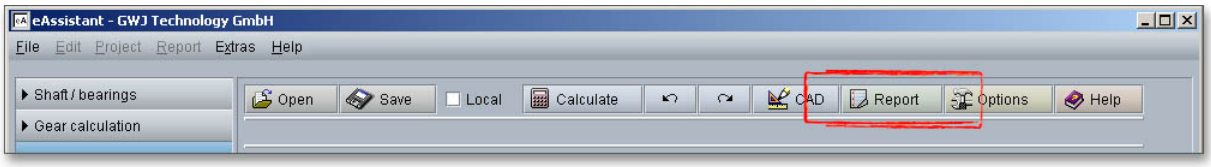

Figure 19: Button „Protokoll“

You may also print or save the calculation report:

- To save the report in the HTML format, please select 'File' ⇒ 'Save as' from your browser menu bar. Select the file type 'Webpage complete', then just click on the button 'Save'.
- If you click on the symbol 'Print', then you can print the report very easily.
- When you click on the symbol 'PDF', then the report appears in the PDF format. If you right-click on the PDF symbol, you should see the 'Save Target As' option. Click on that option and you will see the dialog box for saving the report.

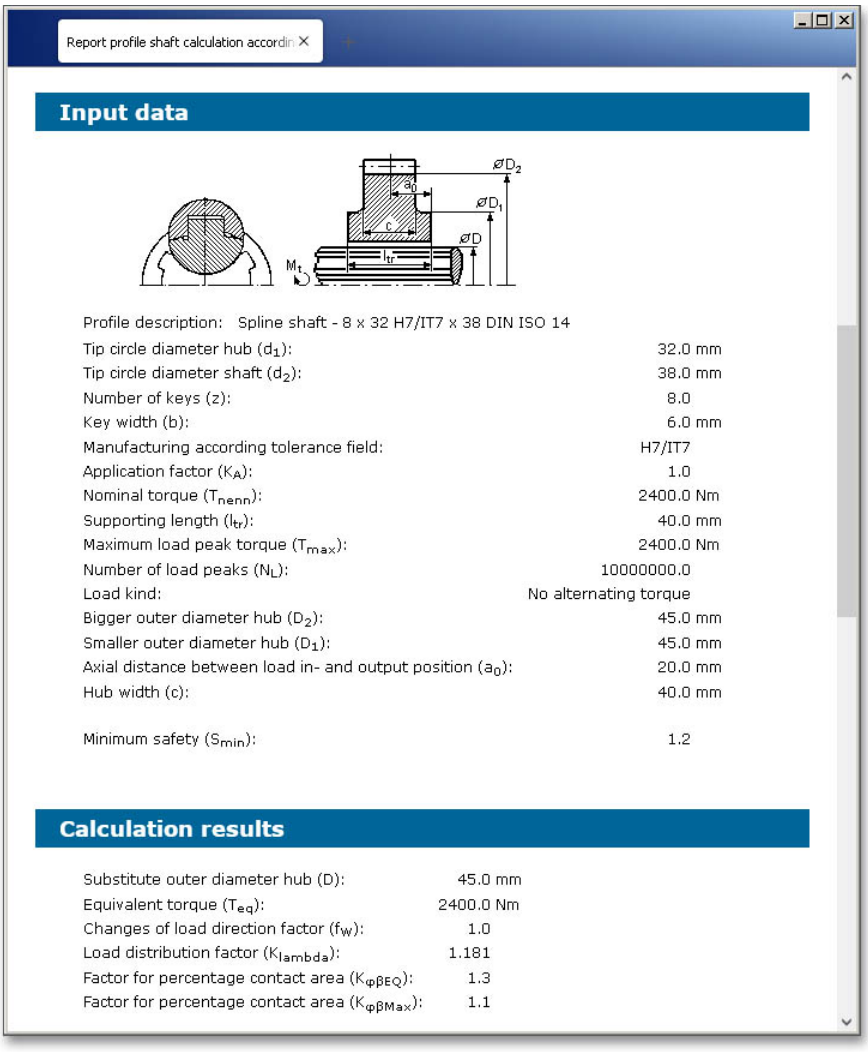

Figure 20: Calculation report

0.1.6 How to Save the Calculation

When the calculation is finished, it is easy to save the calculation. You can save your calculation either to the eAssistant server or to your computer. Click on the button 'Save'.

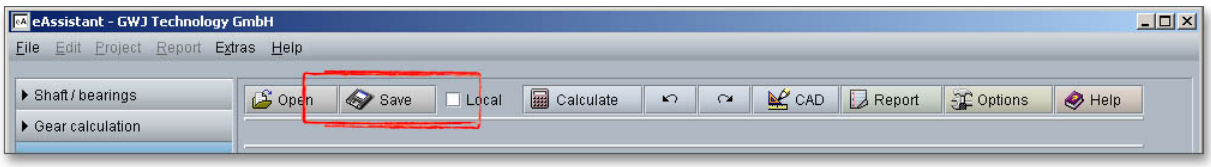

Figure 21: 'Save' button

Before you can save the calculation to your computer, you need to activate the checkbox 'Local' in the calculation module. A standard Windows dialog for saving files will appear. Now you will be able to save the calculation to your computer.

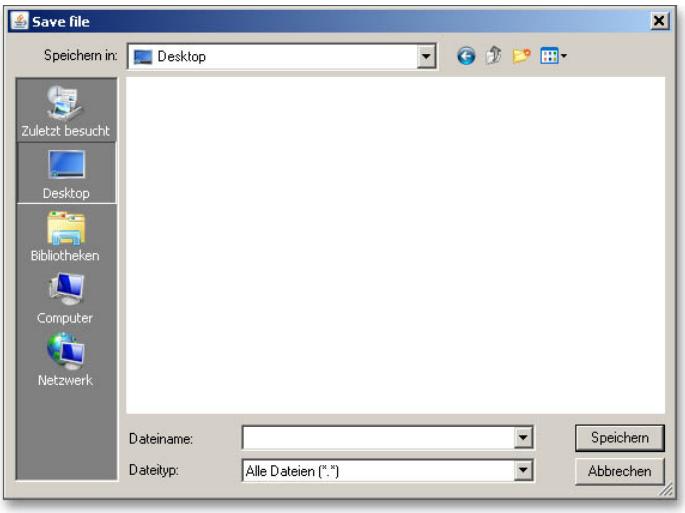

Figure 22: Windows dialog for saving the file

In case you do not activate the option in order to save your files locally, then a new window is opened and you can save the calculation to the eAssistant server. Please enter a name into the input field 'Filename' and click on the button 'Save'.

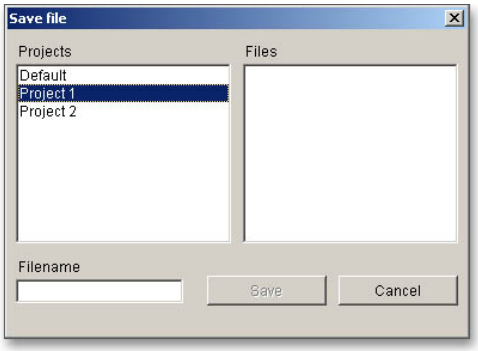

Figure 23: Save the calculation

Our manual is improved continually. Of course we are always interested in your opinion, so we would like to know what you think. We appreciate your feedback and we are looking for ideas, suggestions or criticism. If you have anything to say or if you have any questions, please let us know via phone *+49 (0) 531 129 399-0* or email *eAssistant@gwj.de*.