http://en.dwa.de/software-en.html

DWA
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DWA-Software

Activated Sludge Expert 3.0

Software for Standard DWA-A 131
Dimensioning of single-stage activated sludge plants

2019

The German Association for Water, Wastewater and Waste (DWA) is strongly committed to the development of secure and sustainable water and waste management. As a politically and economically independent organisation it is professionally active in the field of water management, wastewater, waste and soil protection.

In Europe DWA is the association with the largest number of members within this field. Therefore it takes on a unique position in connection with professional competence regarding standardisation, professional training and information. The approximately 14,000 members represent specialists and executives from municipalities, universities, engineering offices, authorities and companies.

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Introduction

ACTIVATED SLUDGE EXPERT ("ASX") is a program for the design and recalculation of single-stage activated sludge plants in accordance with the DWA worksheet A 131. An extended version - here referred to as the "combined version" - also includes the calculation of diffused aeration in accordance with the DWA leaflet M 229.

Overview

Data input
One of the main elements of ACTIVATED SLUDGE EXPERT is a multi-page input dialogue. All the values and options required for the calculation are provided in successive steps on the individual pages of this dialogue. In the process, the program adjusts its request for entries to the selected plant configuration and required cleaning target, i.e. only the information is requested that is relevant to the respective situation. All the data can be corrected and changed at any time without restrictions. After complete entry of the calculation data, the results are displayed in a freely configurable output area on the screen.

Calculation
The calculation is carried out simultaneously with the input. An integrated evaluation system provides you with continuously updated information on guideline and limit values within the input dialog. The evaluation system also indicates any implausible data and issues warnings or error messages when critical or impermissible values are reached.

Data storage
You can save the entered and calculated data in files at any time and read them in for further processing if necessary.

Output of results
The results are displayed both on the screen and on the printer using template files in HTML format. You can change these templates and thus the entire display within a wide range by creating your own templates or changing the templates supplied. For this you can use common word processing programs or text or HTML editors.

Data export
An export function, which can also be configured via templates, allows the entered and calculated data to be made available for further processing with other programs.

Assistance
In addition to an online manual, the program is equipped with a context-oriented help function.

About this manual

This manual describes the functions and operation of the program. For this, basic knowledge of the handling of important functions of the Windows operating system, such as the handling of directories and files, is required.

This manual does not replace the DWA work sheets and leaflets mentioned above. It therefore does not contain a description of the formulae. Supplementary information on further specifications by the committees and on special features of the calculation resulting from the technical implementation of the program can be found in the chapter "Performing calculations" or in the integrated online help.

The following typography is used (as an example):

- File | Open: Menu items of the program or the operating system, menu items or submenus are separated from the main menu above by a vertical line.

- ACTIVATED SLUDGE EXPERT: Internal program names such as variable names and program functions.
FIf the illustrations in this manual are not identical with the delivered program version, this is not an error, but the result of a program or example update.
FAll products mentioned in this manual are trademarks of their respective manufacturers.

User support

Updates and supplements can be found on the Internet at

www.dwa.de/software

Please send any suggestions for improvement and information on possible program errors to the email address

bexpert@gfroese.de

Requirements

ACTIVATED SLUDGE EXPERT runs under Windows xp, Windows 7, Windows 8 and Windows 10.
The hardware requirements set by the program are fulfilled by most of today's computers.

Installation
Open the downloaded ".zip file" with a "unzip program" such as "WinZip", "7-zip" or "FilZip" and extract the file "setup.exe" to a hard disk directory of your choice. Then start "setup.exe" and follow the instructions on the screen.

Licensing and Activation

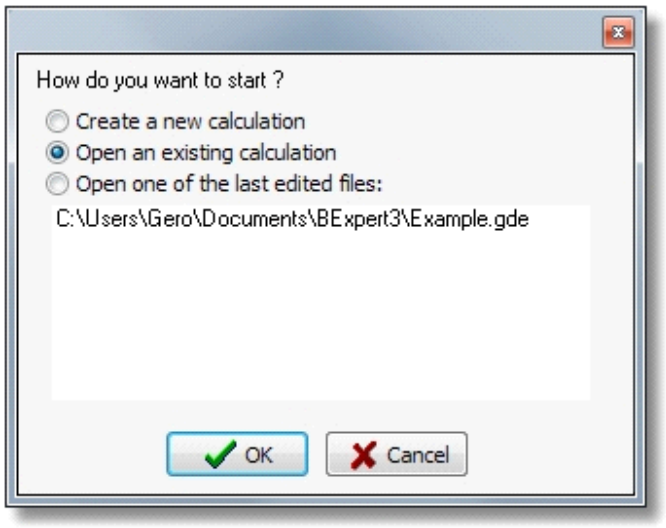
The program is basically delivered in a functionally limited evaluation version.
In order to use the full range of functions, you must purchase a license and activate it on your computer.
Proceed as follows:

Start the program on the computer on which you want to activate the activation expert license.
Call the menu function Help | Registration and click on Register now in the registration dialog...
Follow the instructions on the displayed dialog page.

A quick "walk through"

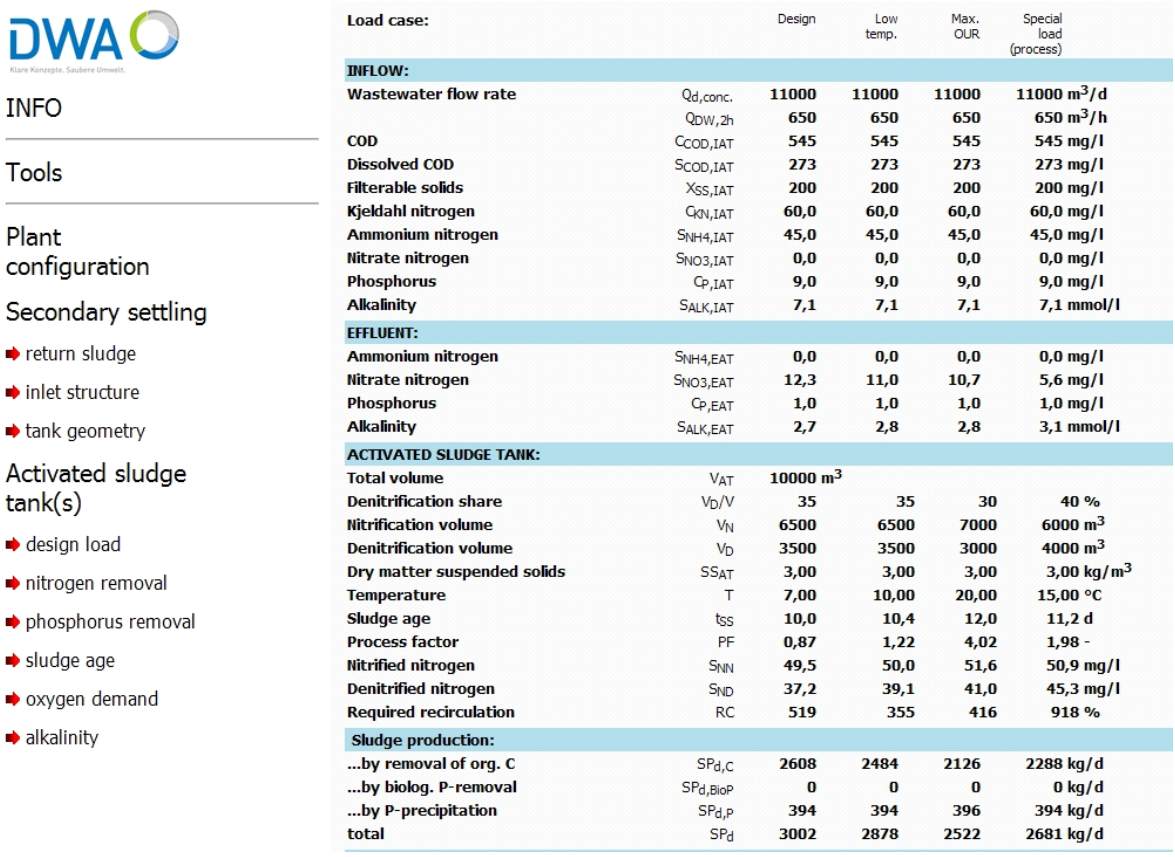
Probably the easiest way to get to know the program in its most important functions is to go through the included example.

Proceed as follows:
Start ASX and select "Open an existing calculation" in the start dialog. Confirm the selection with OK.



You will be taken to the Open File dialog where you click on the example.gde file.

After reading the file, the standard output page appears for a completely created calculation example with four load cases:



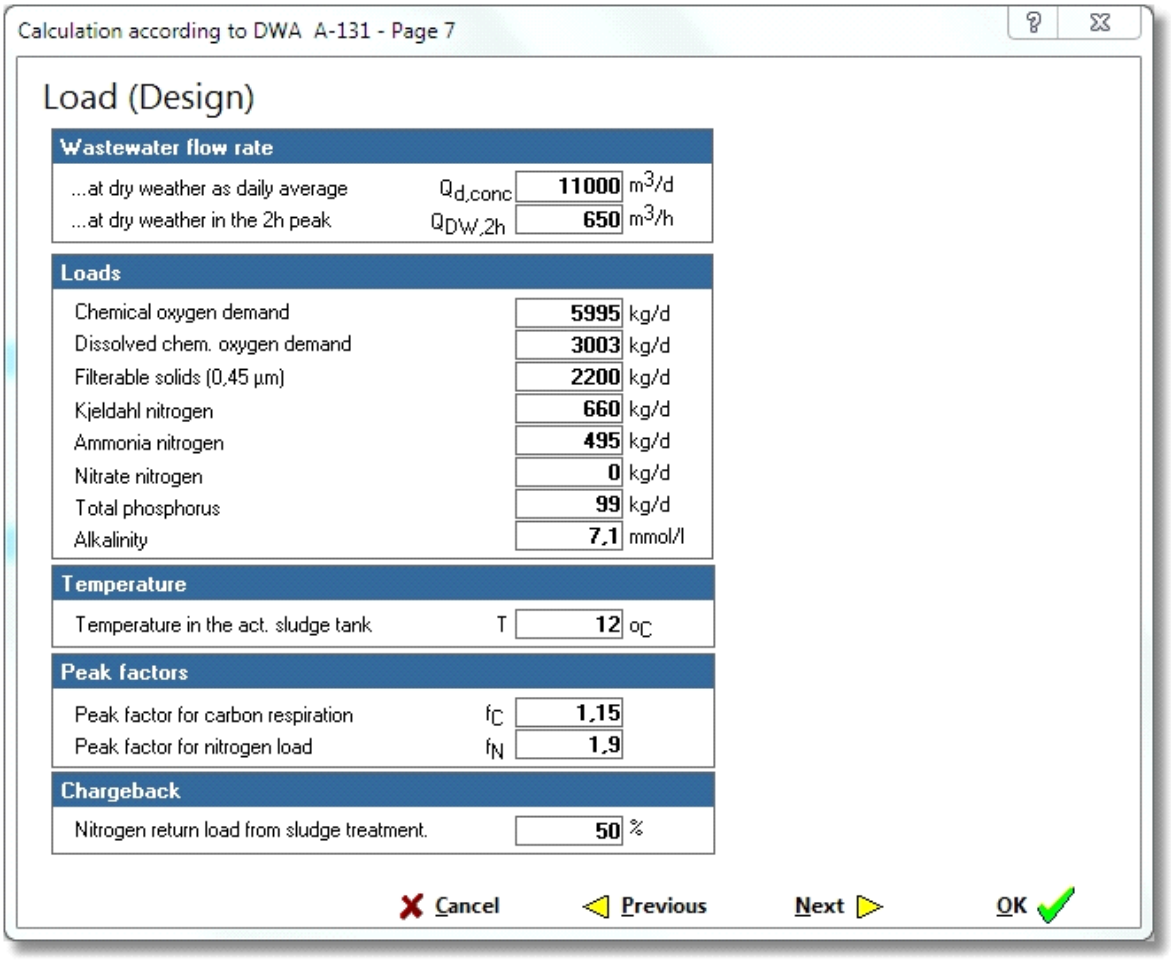
Load case:		Design	Low temp.	Max. OUR	Special load (process)
INFLOW:					
Wastewater flow rate	$Q_{d,conc.}$	**11000**	**11000**	**11000**	**11000 m³/d**
	$Q_{DW,2h}$	**650**	**650**	**650**	**650 m³/h**
COD	$C_{COD,IAT}$	**545**	**545**	**545**	**545 mg/l**
Dissolved COD	$S_{COD,IAT}$	**273**	**273**	**273**	**273 mg/l**
Filterable solids	$X_{SS,IAT}$	**200**	**200**	**200**	**200 mg/l**
Kjeldahl nitrogen	$C_{KN,IAT}$	**60,0**	**60,0**	**60,0**	**60,0 mg/l**
Ammonium nitrogen	$S_{NH4,IAT}$	**45,0**	**45,0**	**45,0**	**45,0 mg/l**
Nitrate nitrogen	$S_{NO3,IAT}$	**0,0**	**0,0**	**0,0**	**0,0 mg/l**
Phosphorus	$C_{P,IAT}$	**9,0**	**9,0**	**9,0**	**9,0 mg/l**
Alkalinity	$S_{ALK,IAT}$	**7,1**	**7,1**	**7,1**	**7,1 mmol/l**
EFFLUENT:					
Ammonium nitrogen	$S_{NH4,EAT}$	**0,0**	**0,0**	**0,0**	**0,0 mg/l**
Nitrate nitrogen	$S_{NO3,EAT}$	**12,3**	**11,0**	**10,7**	**5,6 mg/l**
Phosphorus	$C_{P,EAT}$	**1,0**	**1,0**	**1,0**	**1,0 mg/l**
Alkalinity	$S_{ALK,EAT}$	**2,7**	**2,8**	**2,8**	**3,1 mmol/l**
ACTIVATED SLUDGE TANK:					
Total volume	V_{AT}	**10000 m³**			
Denitrification share	V_D/V	**35**	**35**	**30**	**40 %**
Nitrification volume	V_N	**6500**	**6500**	**7000**	**6000 m³**
Denitrification volume	V_D	**3500**	**3500**	**3000**	**4000 m³**
Dry matter suspended solids	SS_{AT}	**3,00**	**3,00**	**3,00**	**3,00 kg/m³**
Temperature	T	**7,00**	**10,00**	**20,00**	**15,00 °C**
Sludge age	t_{SS}	**10,0**	**10,4**	**12,0**	**11,2 d**
Process factor	PF	**0,87**	**1,22**	**4,02**	**1,98 -**
Nitrified nitrogen	S_{NN}	**49,5**	**50,0**	**51,6**	**50,9 mg/l**
Denitrified nitrogen	S_{ND}	**37,2**	**39,1**	**41,0**	**45,3 mg/l**
Required recirculation	RC	**519**	**355**	**416**	**918 %**
Sludge production:					
...by removal of org. C	$SP_{d,C}$	**2608**	**2484**	**2126**	**2288 kg/d**
...by biolog. P-removal	$SP_{d,BioP}$	**0**	**0**	**0**	**0 kg/d**
...by P-precipitation	$SP_{d,P}$	**394**	**394**	**396**	**394 kg/d**
total	SP_d	**3002**	**2878**	**2522**	**2681 kg/d**

On the right side the entered and calculated values are displayed column by column for the individual load cases. You can use the scroll bars to move the visible part of the output page and view all results.

In the left part you see a bar with different entries. If you move the mouse over these entries, a hand appears as a mouse pointer. Now click with the left mouse button - e.g. on

Design load

the program takes you to the corresponding page of the main input dialog, here to page 7 with the load data for the design load case.



At the bottom of the dialog box you will see buttons that allow you to "browse" through the pages of the input dialog:

Next scrolls forward to the next page of the dialog,
Back scrolls backwards.
Cancel terminates the dialog without data transfer,
OK closes the dialog and transfers the (possibly changed) data to the current calculation file and displays the results on the output page.

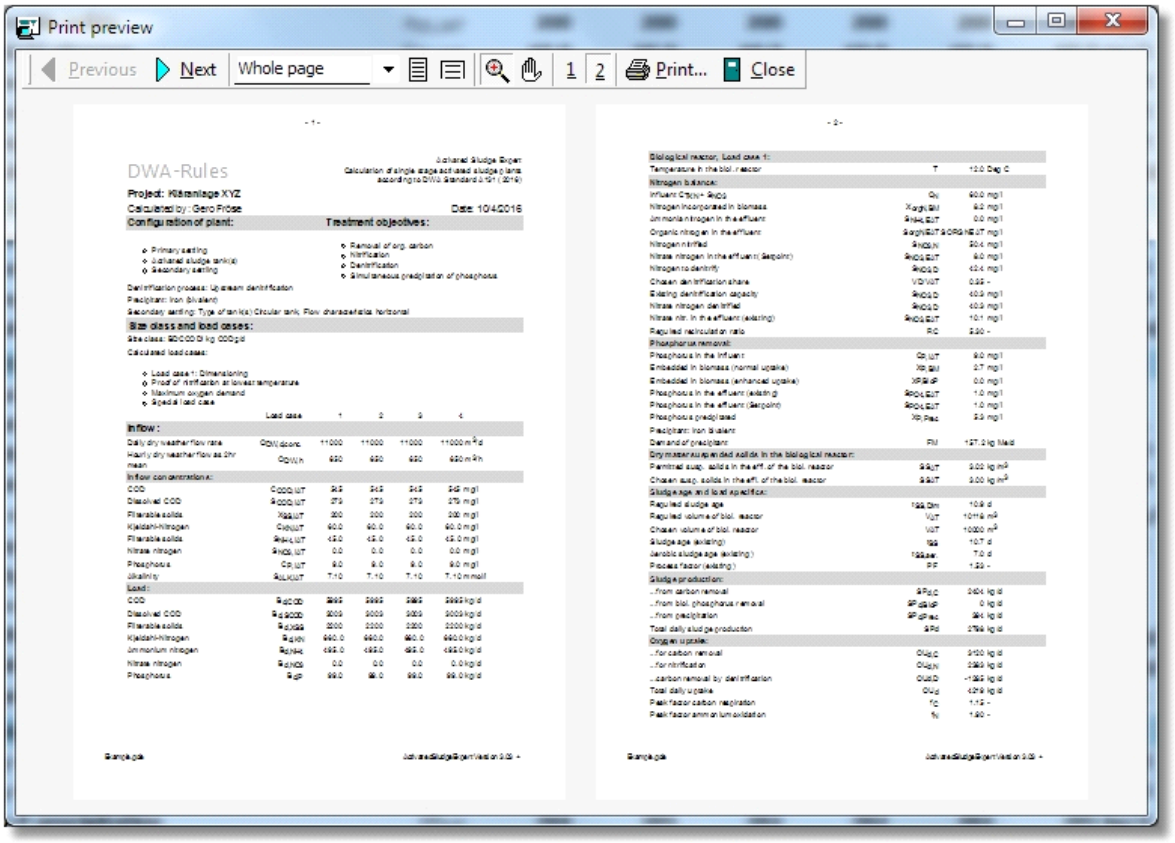
Within a page, you can move from field to field by clicking the mouse or pressing the Tab key. With the Enter key or by exiting a field you confirm the entered value and cause the program to check the entries and carry out a complete recalculation. Please note that a click on OK does not lead to a recalculation.

In order to test the reaction of the program, you should change various values and make conscious mistakes. If, for example, you enter a higher value for ammonium nitrogen in the feed than for Kjeldahl nitrogen, you will receive the following message when you confirm your entries with the Enter key:
NH4 is higher than KN !
The red font color indicates that this is a serious error, which must be eliminated in any case. Serious errors are also indicated by the red background of input fields if the value entered exceeds or falls below the limit values.
In addition to such indications of serious errors, you will also receive indications or warnings if an unrecommended combination of input data has been selected or if an entered value exceeds or falls short of the assigned guide values. If, for example, you enter a size class of more than 12,000 kg COD/d and select

"Aerobic sludge stabilisation" as the cleaning target, a message will appear indicating that this constellation is not recommended. The blue text should indicate that this is not a serious error, but only a warning that can possibly be ignored. Warnings that clearly refer to a certain input field are also given by the yellow background of the respective field.
Simultaneous aerobic sludge stabilization
is not recommended for the given plant size

To transfer the changed data to the output page, press the OK button. If you want to discard all changes, click Cancel. In both cases, the input dialog is closed.

Now click on  in the toolbar or select the menu function File | Print Preview. You will then see the results in a display that corresponds exactly to the output on the printer.



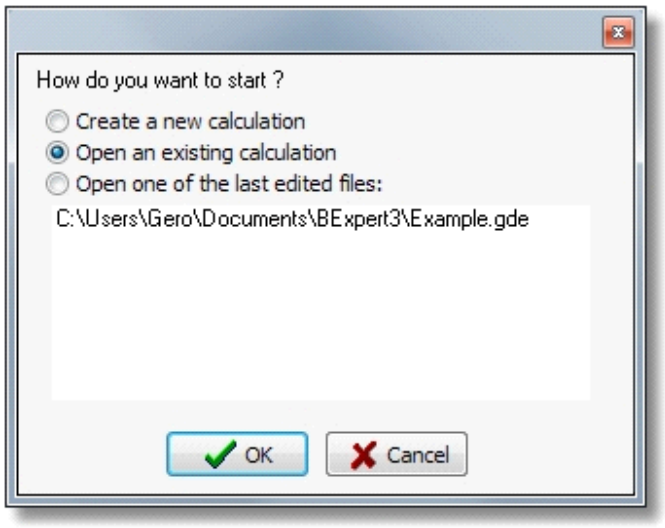
Use the Previous and Next buttons to scroll through this print preview. You can change the size and position of the displayed pages using additional buttons and selection lists. If you have connected a printer, you can use Print... to print all or part of the pages. With Close you end the print preview and return to the standard screen.

The print output shown is based on the "Standard" print template and is only one of several options. Further print templates, which are essentially intended as short overviews of results, are available, for example, "Activated_Sludge_Tank" and "Secondary_Settling". You can set the desired template by expanding the right selection list in the toolbar and selecting the appropriate name from the list.
You can also print the results as they appear on the screen in the standard output sheet. To do this, click on the  icon or select the menu function File | Templates | Printer output. In the "Select Print Template" dialog, enter "HTML Files" as the file type and "Table.htm" as the file name and then click Open.
If you now call up the print preview again, you will see the results in a display that corresponds to the screen template.

Operation

Start-dialog

In the standard setting, a dialog box appears after starting the program, in which you can choose between different options:
Clicking on Create a new calculation and confirming with OK takes you directly to the main input dialog, where you can enter and edit all data for your new calculation.
Clicking on Open an existing calculation and confirming with OK takes you to the Open File dialog box. Here you have the possibility to search for an existing calculation file in your directory structure. After successful reading of the file, the program main window with the output form is displayed.
By clicking on a file in the list of recently edited files, the relevant file is read and then the main program window with the output form is displayed.
Pressing Cancel leads to the main window of the program described below. In this case, the work area is empty.
.

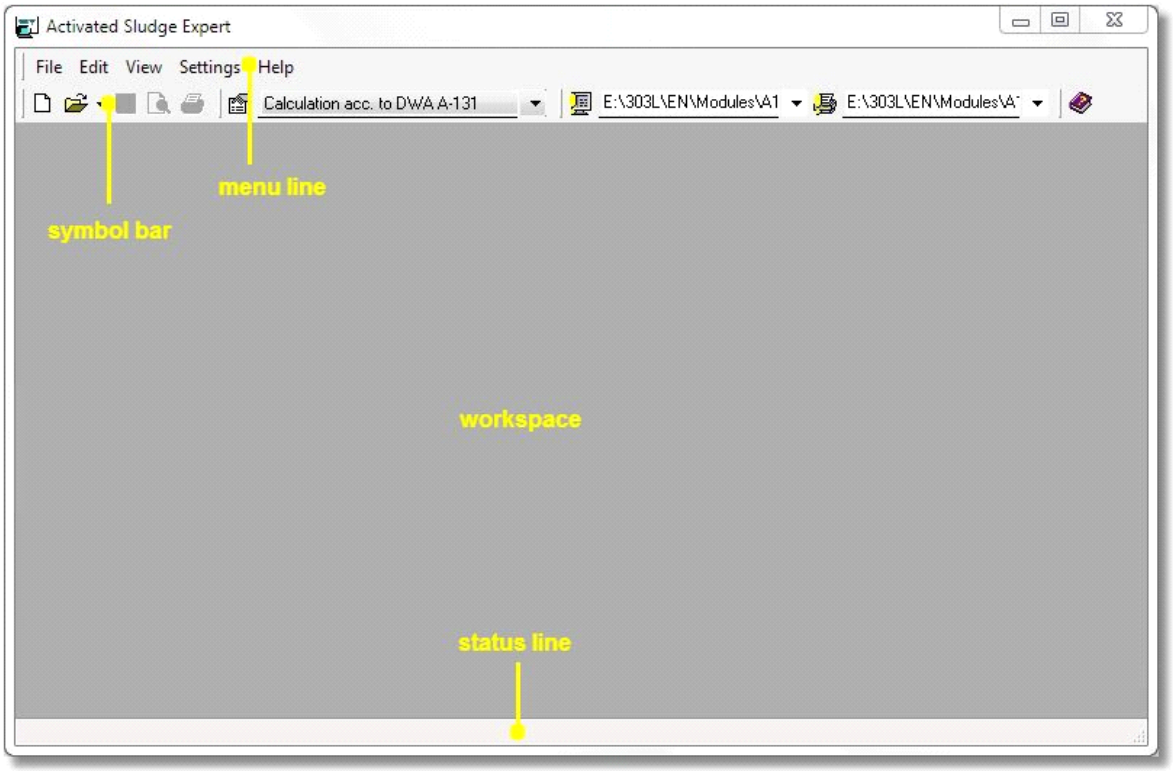


You can suppress the display of this dialog by deselecting the "Start dialog" option in the "Settings" menu.

Screen layout

As with many other Windows programs, the main window of the program consists of the following elements:
Menu bar
Toolbar
Status line and
Workspace

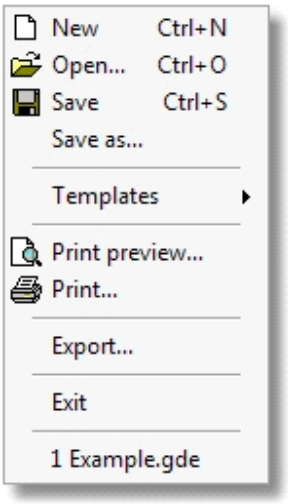
The workspace is shown as "empty" in the figure below. If a calculation is open, the results are displayed here in a form defined by the screen template.
In the title bar (Windows program bar) the program name and, if applicable, the name of the opened calculation file appear.



Menu functions

Menu "File"

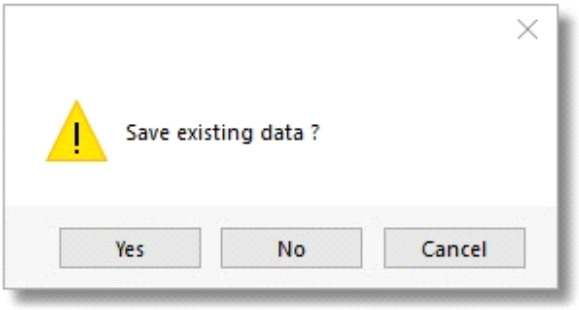
The menu items in the File menu are briefly introduced below. The special features typical for ACTIVATED SLUDGE EXPERT are explained in detail in the following chapters.
Some of the menu items are marked with symbols, which you will find in the symbol bar. Some menu items are followed by key combinations with which you can activate the relevant function at any time (e.g. Ctrl+N to create a new file).



The submenu shown here contains all items in black font color. This is the case if a file is open or a new calculation has been completely created using the input dialog. If no calculation data are available, e.g. after program start, the non-selectable points are marked with grey font.

File | New

By calling this function, you create a new calculation using the main input dialog. If a calculation has already been opened and the data has been changed, you are asked whether the existing changes should be saved:



If you confirm with Yes, a "Save file" window opens in which you can enter a file name. If you select the Cancel function instead of a file name, the existing file is not saved!

If you select No, the existing data will not be saved.

The Cancel selection returns to the initial screen.

File | Open

Open an existing calculation file for further processing or to output the results to screen and printer. If a file has already been opened and modified, a dialog for saving the modified results is displayed here as well as under File | New.

File | Save

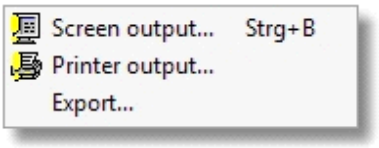
Save all entries and results of the current calculation in a calculation file. If no file name has yet been specified for the current data, the Save Data dialog box is automatically opened, otherwise the saved results are overwritten and the old file name is retained.

File | Save as...

Corresponds to the Save function. Before this, however, a dialog box asks for a file name. You also call this function if a file name already exists for the current data, but you want to save the data under a different name for later changes.

File | Templates | ...

Templates can be selected for the output of the results on the screen or printer via further submenus:



The selection points

Screen output..., Print output... and Export...
lead to the respective dialogs for selecting the template files.
These functions are described in the chapter Template files.

File | Print preview

You receive a complete preview of the print result according to the selected print template. The functions of the print preview are explained in the chapter Print preview closer.

File | Print

The results of the calculation are output to the printer using the selected print template.

File | Export

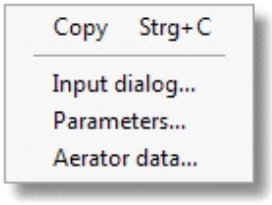
The results of the calculation are written to a file using the selected export template. Before this, a dialog box asks for a file name. The file extension preset in this dialog corresponds to the format of the current template file; it should be retained in order to avoid format problems when further processing the exported data with other programs.

File | Exit

Exit the program.

File list
The menu below shows the most recently saved files, which you can open immediately by clicking on them.

Menu "Edit"



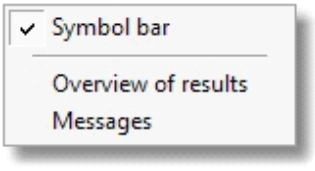
Copy allows you to copy selected areas from the result form to the clipboard.

Via Input dialog... you reach the main input dialog for editing the design data.

Via Parameter... you call the dialog for editing the model parameters.

Via Aerator data... you reach a dialog box for defining and editing aerators. This function is only available in the combined version of the program.

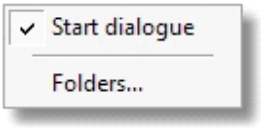
Menu "View"



Symbol bar: Selecting this menu item switches the symbol bar off or on.

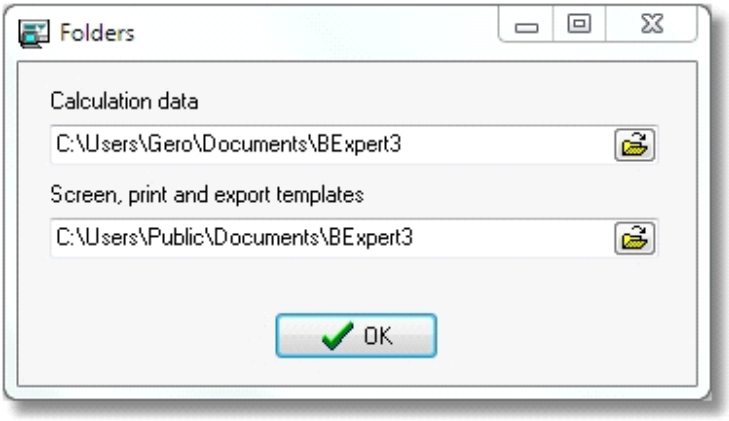
Results overview: The calculation results are displayed on the screen according to the selected screen template.

Messages: All messages generated by the program in connection with the current calculation are displayed in an overview on the screen.
Menu "Settings"



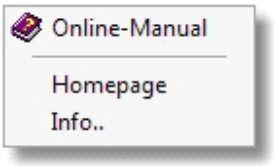
Start dialogue: Selecting this menu item activates or deactivates the start dialog.

Directories: After calling this menu function, a dialog window appears in which you can specify the directories in which the program searches for and saves calculation data and templates.



Menu "Help"

Online manual: leads to the online manual



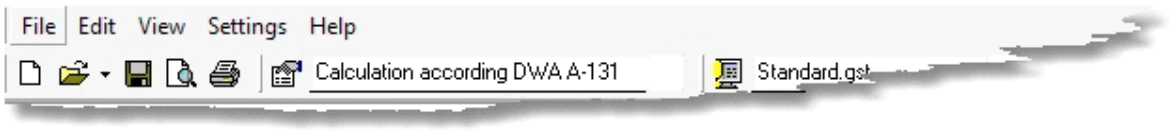
Registration...: calls the dialog for registering the program for an evaluation version.

Homepage: if internet access is available, you can use this menu item to call up the program's internet pages. Here you will find the current program version, information on additional programs and further information.

Info...: shows a screen window with information about the program version and the registration code. und den Registriercode.

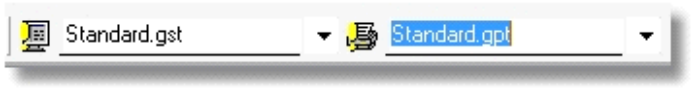
Symbol bar
As an alternative to a menu selection, you can also call some functions from the symbol bar. This consists of several sub-bars in which symbols that logically belong together are arranged together.

You can place these sub-bars anywhere on the screen by clicking on them with the marked handles on the left and moving them to the desired position.



If this location is outside the symbol bar area, the bar appears like a normal Windows window with a title bar and "crosses" to hide it. You can reset the moved toolbar to its original location at any time.

The symbol bar contains the same symbols and functions as the menu functions already described. It also contains selection menus and displays for the available and currently set screen and print templates.



Select a screen template:
To change the screen template, click the  icon. A file selection dialog appears where you can choose between the following file types:

Screen Templates

HTML files
All files.

The selected file is used as the screen template. In general, you should select a file with the extension ".gst", as it contains a template adapted to the screen display.
For more information on the file types, refer to the "Output customization" chapter.
You can also select the template files available in the program directory using a selection list, which is displayed by clicking the small arrow. This list contains all *.gst files.

Selection of a print template:
The selection of the print template works in the same way as that of the screen template, i.e. on the one hand via the file selection dialog and on the other hand via the expanded selection list. The templates adapted for print output have the extension ".gpt".

Data input
The input or processing of the calculation data takes place via two or three dialog windows:

Main input dialog
Parameter dialog
Aerator dialog (only in combined version)

Normally, you will work almost exclusively with the main input dialog to enter or change the usual calculation data and thus interactively create your calculation. The parameter dialog, on the other hand, contains data that is more or less defined in the worksheet and can therefore only be changed in special situations - for example, if in individual cases reaction kinetic characteristic values deviating from the standard values were determined by tests.
Main input dialog
The main input dialog comprises 19 pages in the standard version of the program and 26 pages in the combined version. These are divided into the following sections:

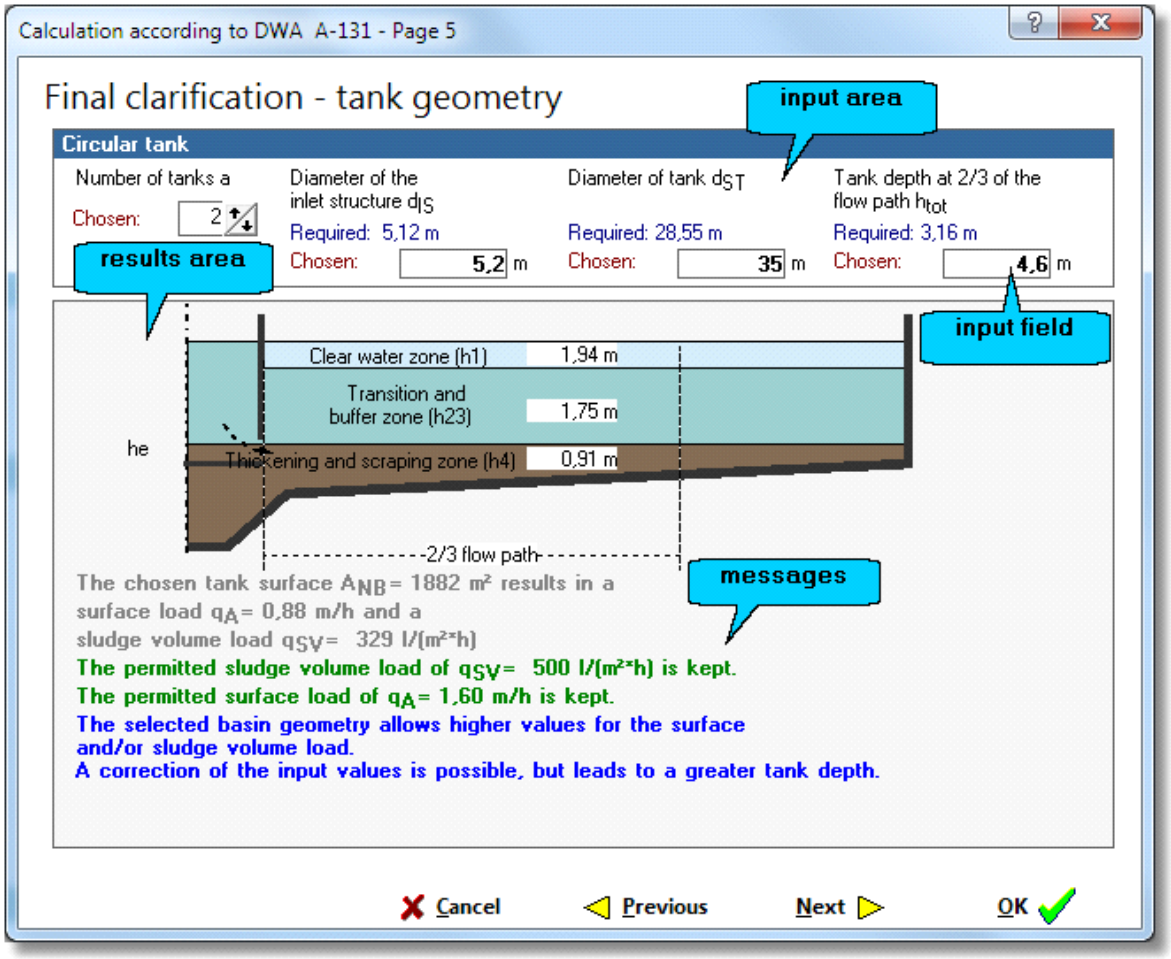
General specifications for documentation and control of the calculation process.
Process selection
Load data
Calculation of the final clarification
Calculation of the activated sludge tank
Calculation of different load cases
Calculation of aeration (only in combined version)

As the content of the pages is based on each other, it is recommended to edit them in the given order. In some situations, however, it may be necessary to go back one or more pages because, for example, other limits have arisen in the course of the calculation and a corresponding correction of values already entered is useful or even necessary. In such cases, you will receive corresponding information. Furthermore, changes to certain values can influence the correction of input values on other pages. Especially after

changing the cleaning targets or the process engineering specifications, you should therefore check all pages for possible warnings or error messages (example: by changing the dimensions of the inlet structure, it may be necessary to correct specifications for the geometry of the entire final clarifier).
Please also note that the program only requests the values that are required for the selected calculation run. This means that certain pages may be hidden depending on treatment objectives and process specifications, and that the content of the pages may vary.

Layout

The figure shows an example of a page of the main input dialog.



In general, the input fields with a heading are grouped thematically into input areas (in the example above, "Circular tank"). The different types of input fields are explained in the following chapter.
Areas with a grey background are reserved for messages and results. There you will get hints from the evaluation module of ACTIVATED SLUDGE EXPERT. If the message text exceeds the size of this area, scroll bars appear at the edges. These can be used to adjust the image section.

Operating controls
At the bottom of the dialog box, you will see buttons that allow you to scroll through the pages of the main input dialog and exit the dialog with or without data transfer:

Next scrolls forward to the next page of the dialog,
Previous scrolls backwards.
Cancel terminates the dialog without data transfer (all changes are discarded),
OK transfers the data into the current calculation file and into the result display.

The "OK" button is missing for a new calculation (File | New). Instead, the "Finish" button is located on the last dialog page. This arrangement is intended to prevent you from accidentally closing the dialog before

all pages have been edited. Functionally, "Finish" corresponds to the OK button.

Input fields

The main input dialog contains different types of input fields:

Numeric input fields

Only digits and the decimal separator are accepted. The input in the field is accepted as valid if the field is left with the tab key or mouse pointer or the input key is pressed.

The background color of the number field is changed by the program in :

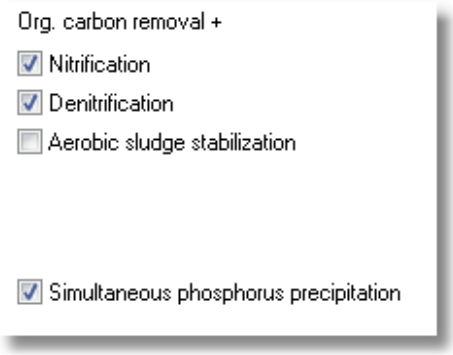
yellow as a warning when exceeding or falling short of guide values:

red in case of an alarming limit value violation, as shown here with the example of the sludge dry matter in the outlet of the activated sludge tank (= inlet of the secondary clarifier):

Text input fields

All displayable characters are accepted. Text entries are only provided on the first page of the input dialog for project identification.

Option fields ("checkboxes")
These fields are used to select or deselect certain properties or options. The example shows the selection of "Treatment objectives" on page 2 of the input dialog.
In principle, it is possible to "tick" several fields as in the example shown. If a selected option includes another one, the program automatically takes this into account.



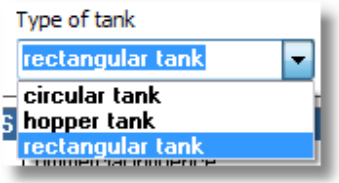
A special type of option fields are the "Transfer from design load case" fields on the load case dialog pages.
Selecting these fields causes the corresponding values from the design load case to be transferred to the following group of input fields. If one of these numerical values is subsequently changed, ACTIVATED SLUDGE EXPERT automatically deletes the check mark in the option field to indicate that the values from the design case are no longer automatically transferred. However, the previously accepted and unchanged values are retained. If the option field is activated again, the numerical values from the design load case are transferred again.

Selection groups ("radio buttons")

Round fields are used for alternative selection of settings, in which a dot appears instead of a checkmark. In the example shown (page 3 of the input dialog), you can alternatively select between concentration and freight input for the following load cases.

Selection lists

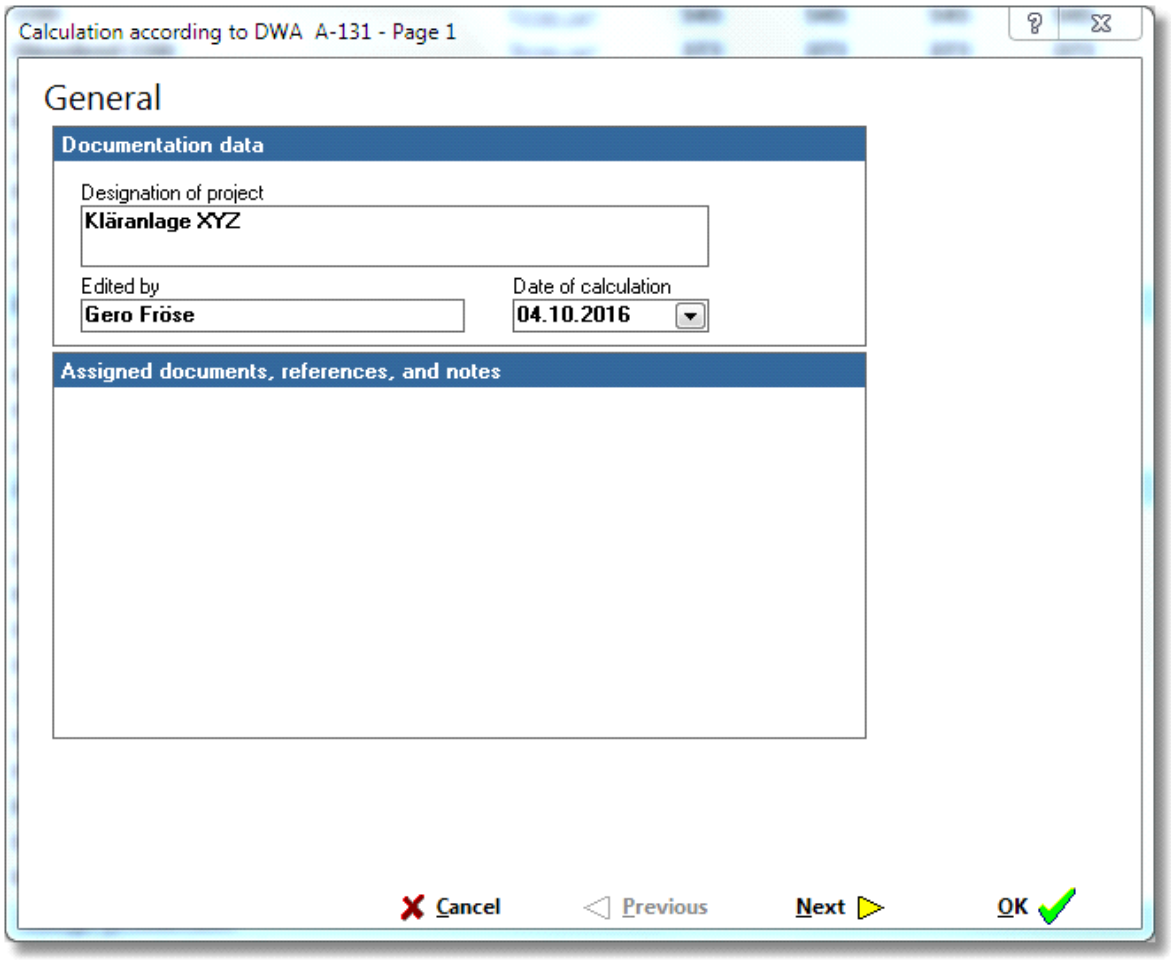
Clicking the arrow next to the field opens a selection list - here e.g. with clarifier types. One entry of each of these can be accepted as valid.



Performing calculations
As already mentioned, the design and recalculation is essentially carried out via the main input dialog. While editing the pages of this dialog, the program performs a complete calculation and updates messages and intermediate results each time you leave an input field or press the Enter key within an input field.
This calculation adheres to the definitions in worksheet A 131 with regard to scope and sequence. In case of ambiguities, you should therefore check the situation on the basis of the worksheet. The context-oriented help system is also available.

The following section will deal with some points arising from frequently asked user questions, from special features of the programmatic implementation of the working or data sheet and from further specifications by the technical committees, with reference to the dialogue pages.
Documentation
On the first page of the main input dialog, for later identification of the calculation you can specify a project name, the name of the author, and the calculation date.

In addition, you can make your own text notes in the area overwritten with "Assigned documents, references and notes" and enter links to files (e.g. relevant drawings) or Internet pages or store them by means of "drag and drop". By clicking on such links, you can then directly access the corresponding file or page from the main input dialogue. However, in case of a link to a locally saved file, you need to ensure that the file has not been moved or deleted. A link to an Internet site naturally only works with an active Internet connection.
The entries on this page are of no significance for the calculation.



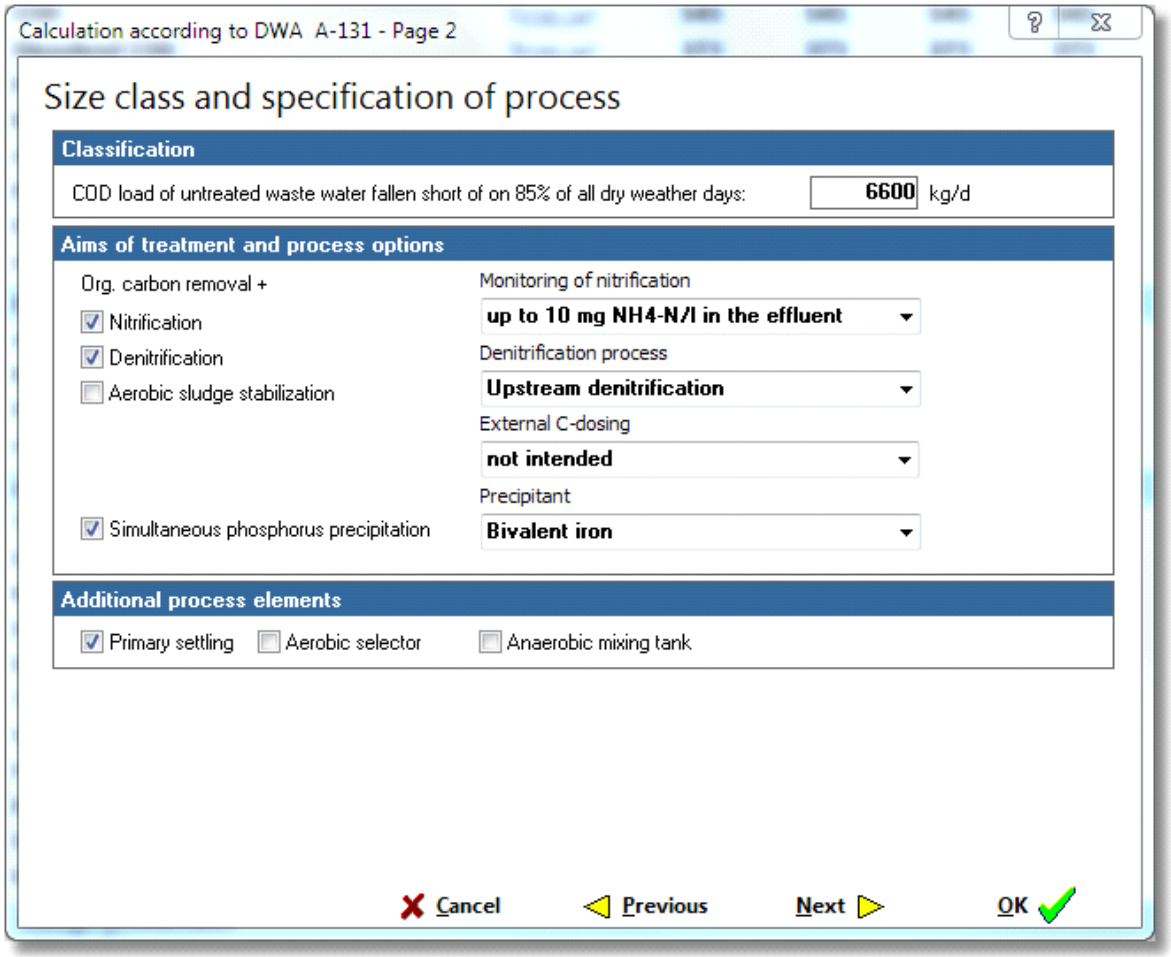
Specification of process

The calculation according to A131 contains numerous case differentiations. This results for example in the required sludge age depending on the size class of the plant and the cleaning targets. In addition, if applicable, a distinction may be made based on the methods for denitrification and phosphorus removal. The corresponding specifications are made on page 2 of the main input dialogue.

The following approaches are used to calculate the mean mixed liquor suspended solids (TSSAT) in a cascade denitrification:

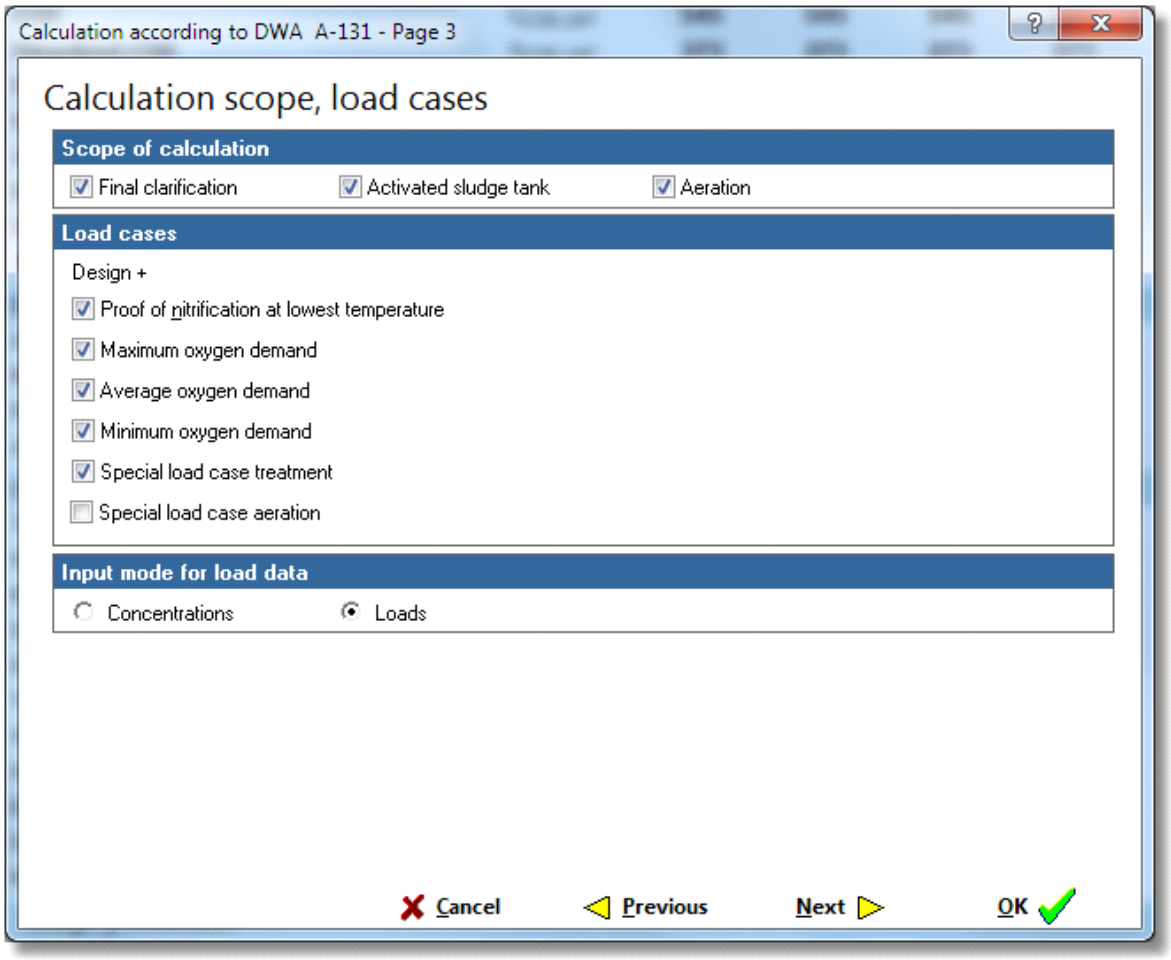
Two-stage cascade: SSAT = 1.14 * SSEAT
Three- and multi-level cascade: SSAT = 1.2 * SSEAT

The statement as to whether there is primary settling or not serves exclusively to calculate the inorganic share of the filterable substances in the inlet (parameter fB). This share is needed for the COD fractionation.
An anaerobic mixing tank causes increased biological phosphorus removal.
The required volume is calculated optionally for an aerobic selector.



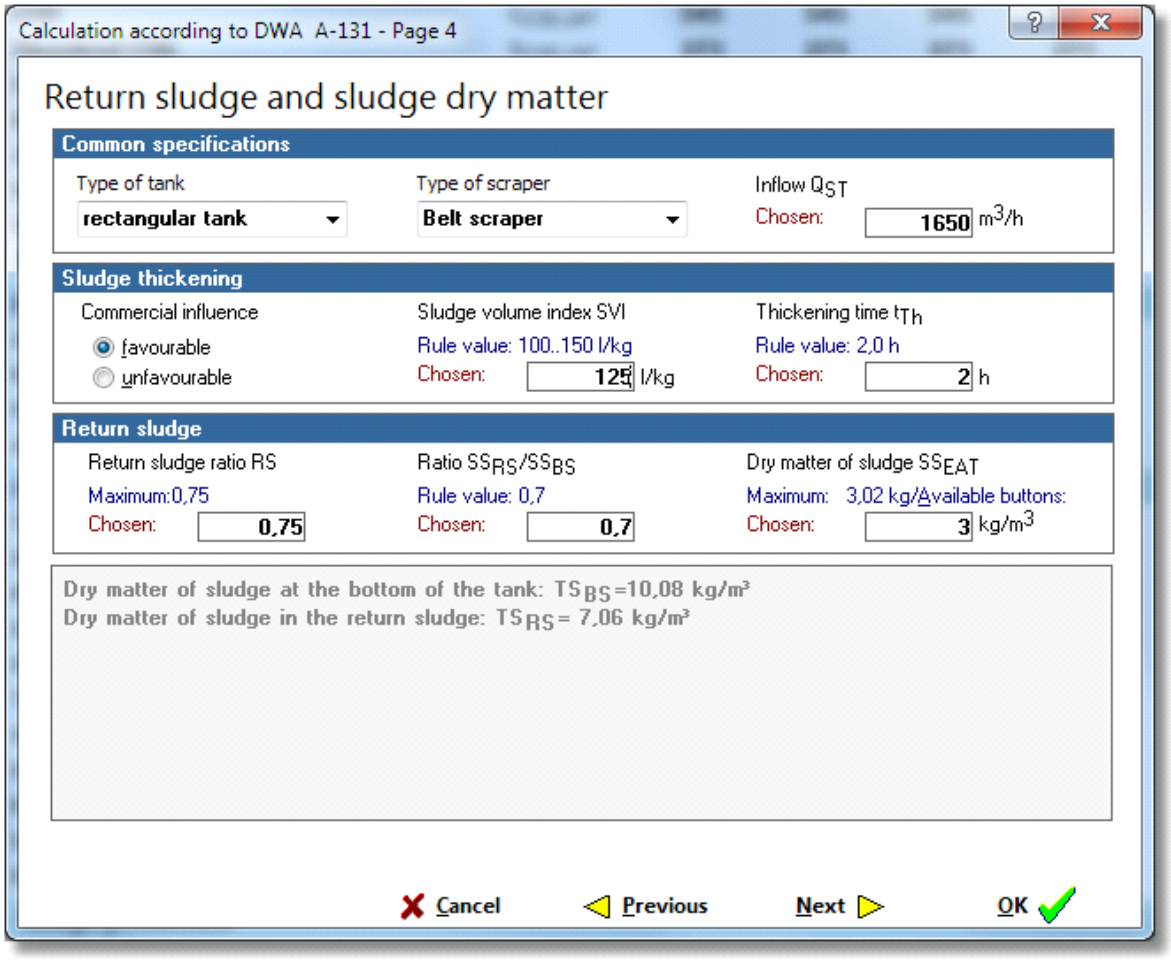
On the following page you select the scope of calculation. For example, you can set the program so that only the final clarification is calculated. In addition, you can determine which load cases are included. The program takes the requirements of A131 into account by automatically activating or deactivating certain load cases depending on the scope of calculation and other procedural specifications. The load cases "Mean oxygen demand", "Minimum oxygen demand" and "Special load case aeration" can only be processed with the combi-version.
Scope of calculations
On the following page you select the scope of calculation. For example, you can set the program so that only the final clarification is calculated. In addition, you can determine which load cases are included. The program takes the requirements of A131 into account by automatically activating or deactivating certain load cases depending on the scope of calculation and other process specifications. The load cases

"Average oxygen demand", "Minimum oxygen demand" and "Special load case aeration" can only be processed with the combi-version.



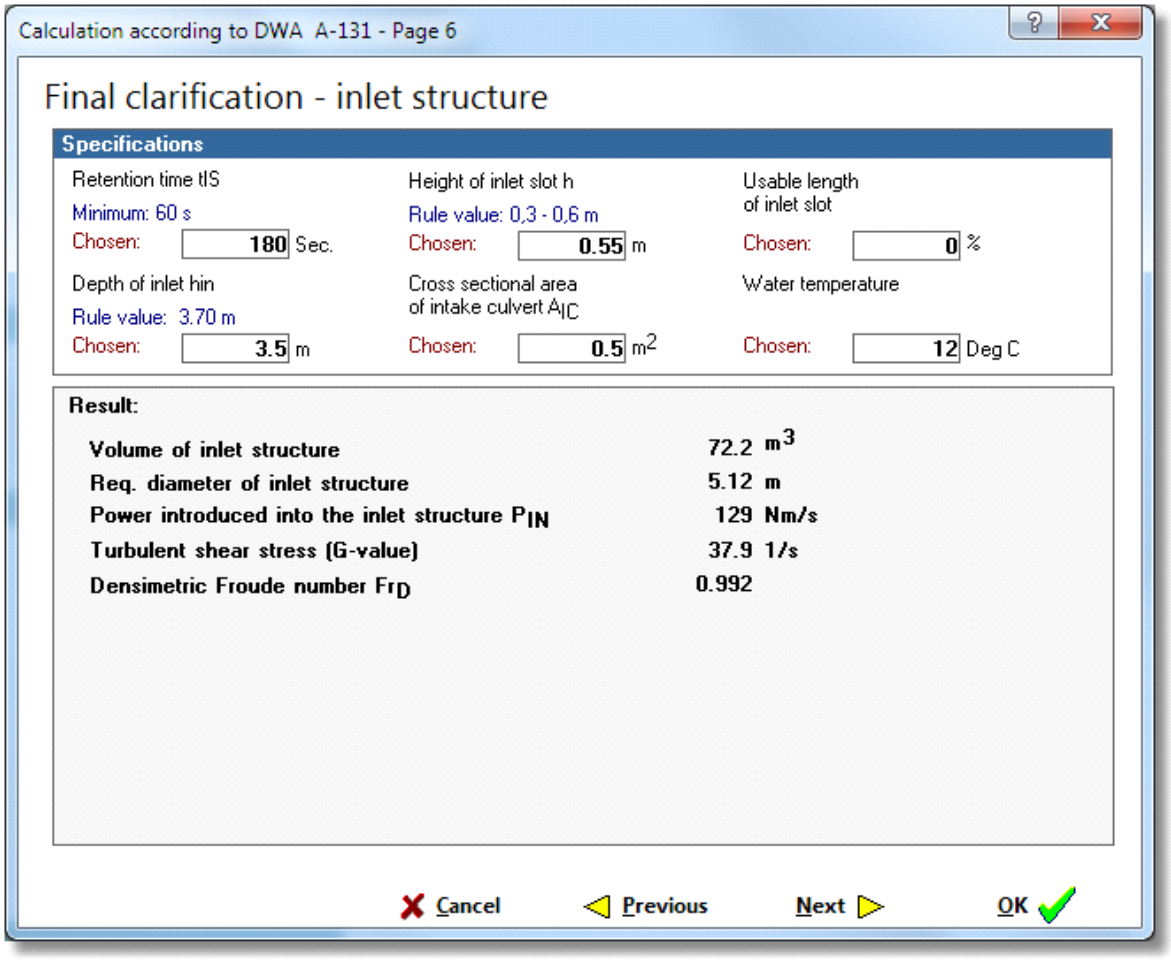
Secondary settling

So as to enable the recalculation of an existing secondary settling tank, the inflow rate can be specified independently of the existing (combined) water flow rate. The term "(proportional) inflow rate" is intended to indicate this possibility. In a recalculation, this inflow rate is to be selected so that the various limit values (surface loading, sludge volume surface loading) are complied with. This results in the capacity of an existing final clarification.

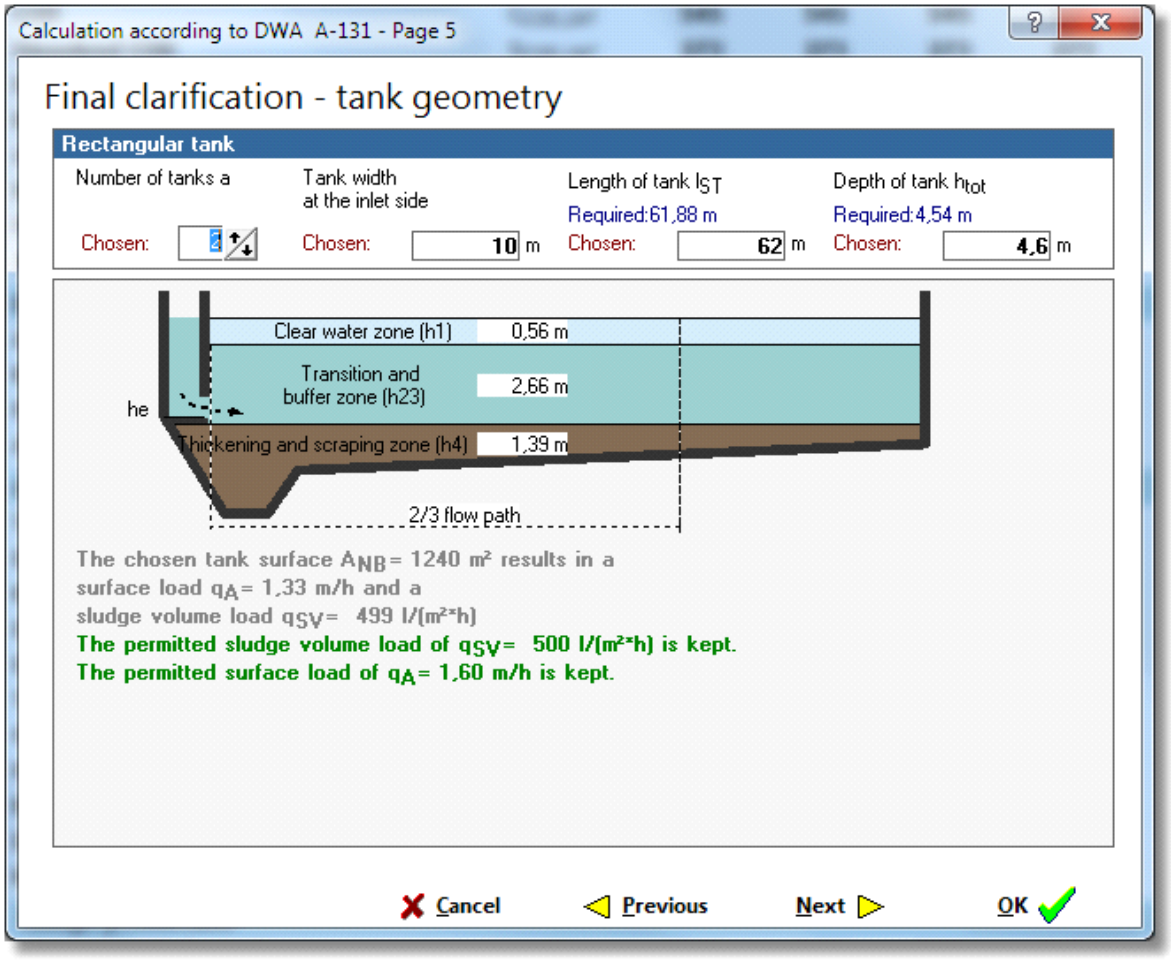


Final clarification – tank geometry

The program automatically calculates the type of flow (horizontal, vertical or transitional area) from the selected tank geometry. Since various limit values depend on the type of flow, limit value shifts may occur during processing which make it necessary or meaningful to change certain input data. In such situations you are provided with appropriate information. The program cannot make the necessary changes automatically, since several input values are affected and a suitable constellation can only be derived from planning considerations. In the case of the hopper-bottomed tank, the tank depth cannot be specified directly. In order to achieve a certain tank depth, the tank diameter and the inclination of the hopper-bottomed tank are to be varied.



For the inlet structure, in addition to the values defined in A131, you can enter the "usable length of the inlet slit" as a percentage. This takes into account that inlet slits generally do not extend over the entire width or the entire circumference of the inlet structure, but are interrupted by supports or the like.

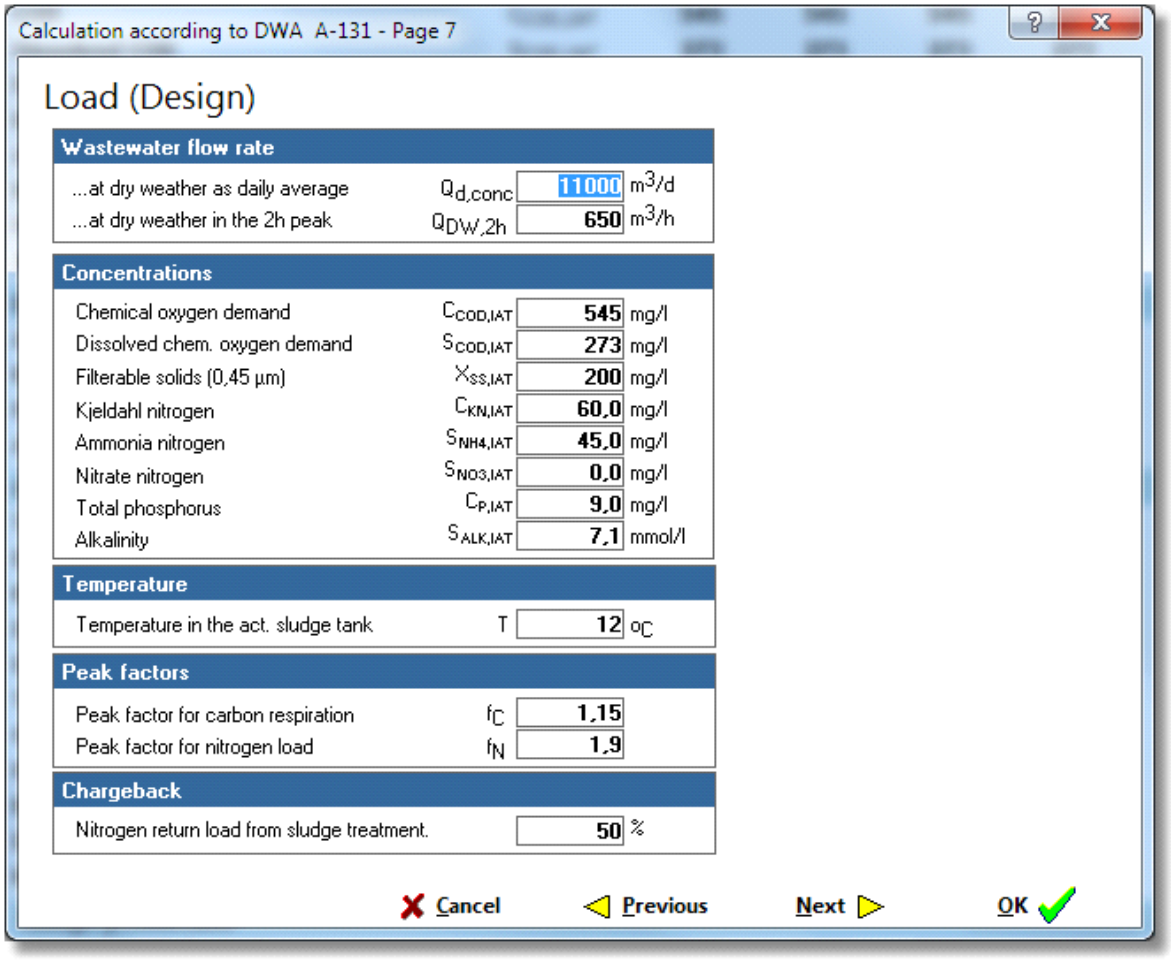


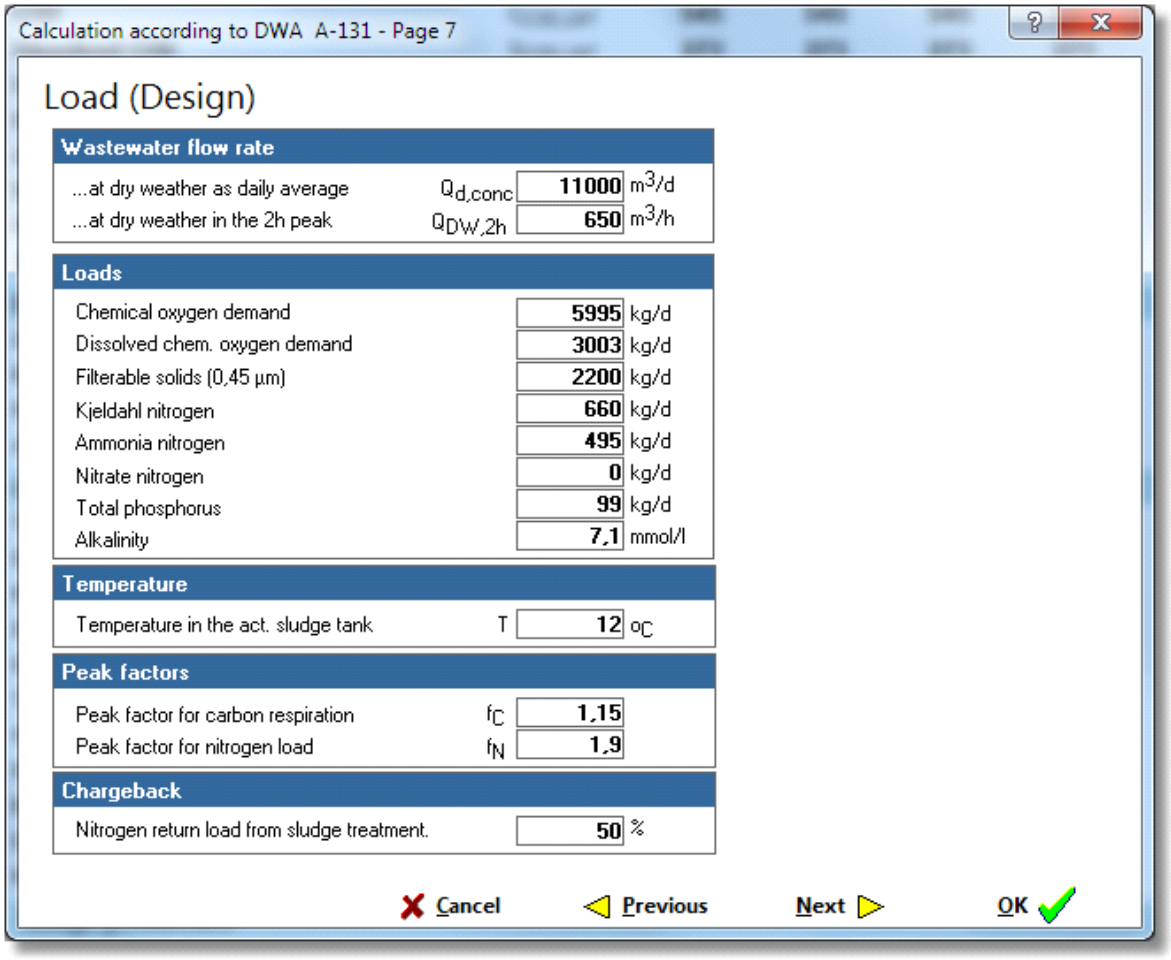
Load data

To enter load data, the main input dialogue contains similar pages for each load case. As an example, the page for the design load case is shown here. Loads or concentrations are to be entered depending on the preselection of the input mode on dialogue page 2. The wastewater flow rate Qd,konz serves to convert between loads and concentrations.

Fundamentally, the inlet concentrations or inlet loads refer to the inlet to the biological stage. Thus, if there is a primary treatment stage, then at the outlet of the primary settling.

The COD fractionation is calculated by the program according to the specifications in Standard DWA-A 131. If no dissolved COD is specified, the calculation is carried out using the filterable substances instead.

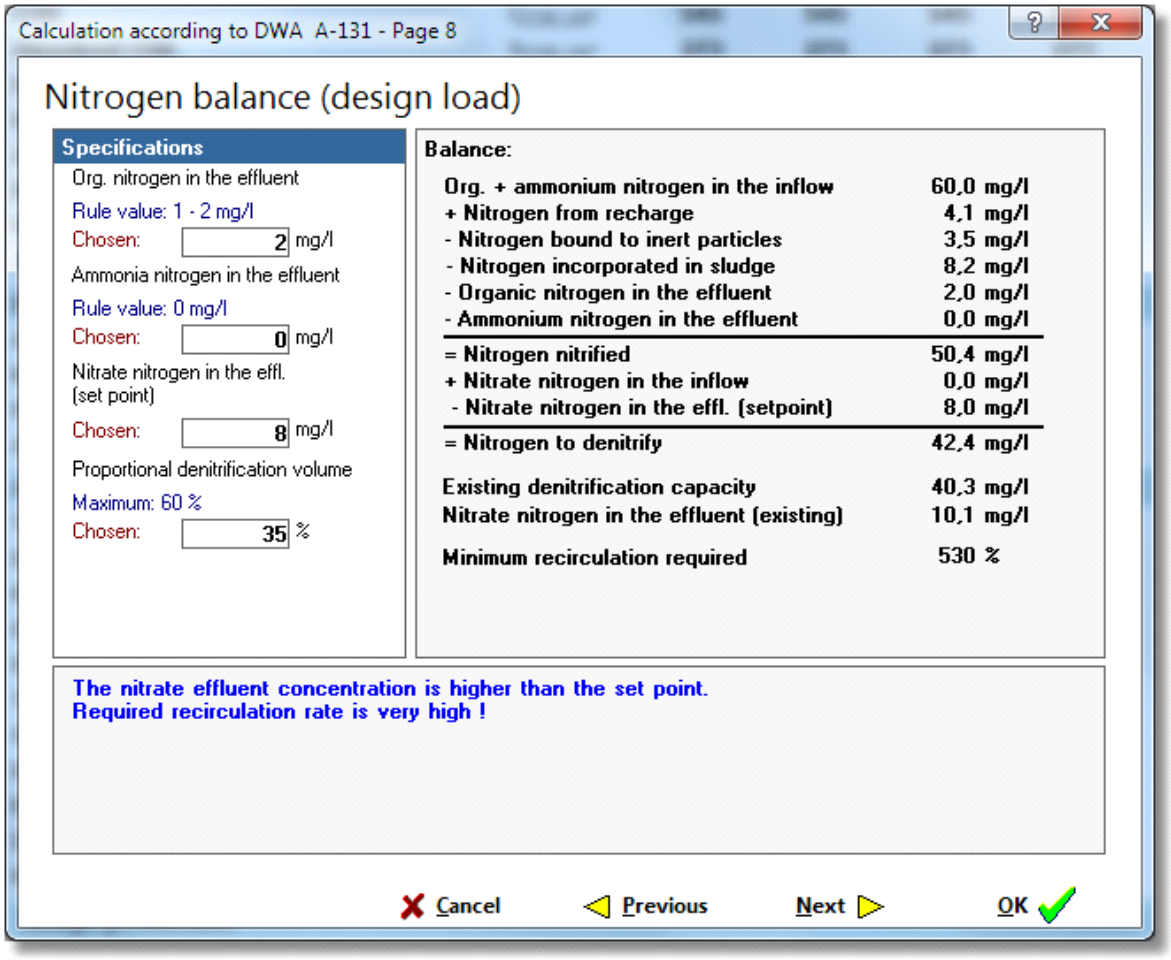

Calculation according to DWA A-131 - Page 7
Load (Design)
Wastewater flow rate
...at dry weather as daily average
$Q_{d,conc}$
11000
m^3/d
...at dry weather in the 2h peak
$Q_{DW,2h}$
650
m^3/h
Concentrations
Chemical oxygen demand
$C_{COD,IAT}$
545
mg/l
Dissolved chem. oxygen demand
$S_{COD,IAT}$
273
mg/l
Filterable solids (0,45 µm)
$X_{SS,IAT}$
200
mg/l
Kjeldahl nitrogen
$C_{KN,IAT}$
60,0
mg/l
Ammonia nitrogen
$S_{NH4,IAT}$
45,0
mg/l
Nitrate nitrogen
$S_{NO3,IAT}$
0,0
mg/l
Total phosphorus
$C_{P,IAT}$
9,0
mg/l
Alkalinity
$S_{ALK,IAT}$
7,1
mmol/l
Temperature
Temperature in the act. sludge tank
T
12
°C
Peak factors
Peak factor for carbon respiration
f_C
1,15
Peak factor for nitrogen load
f_N
1,9
Chargeback
Nitrogen return load from sludge treatment.
50
%
Cancel
Previous
Next
OK



The nitrogen recharge from the sludge treatment is related to the nitrogen incorporation in biomass. Typical values are around 50%.

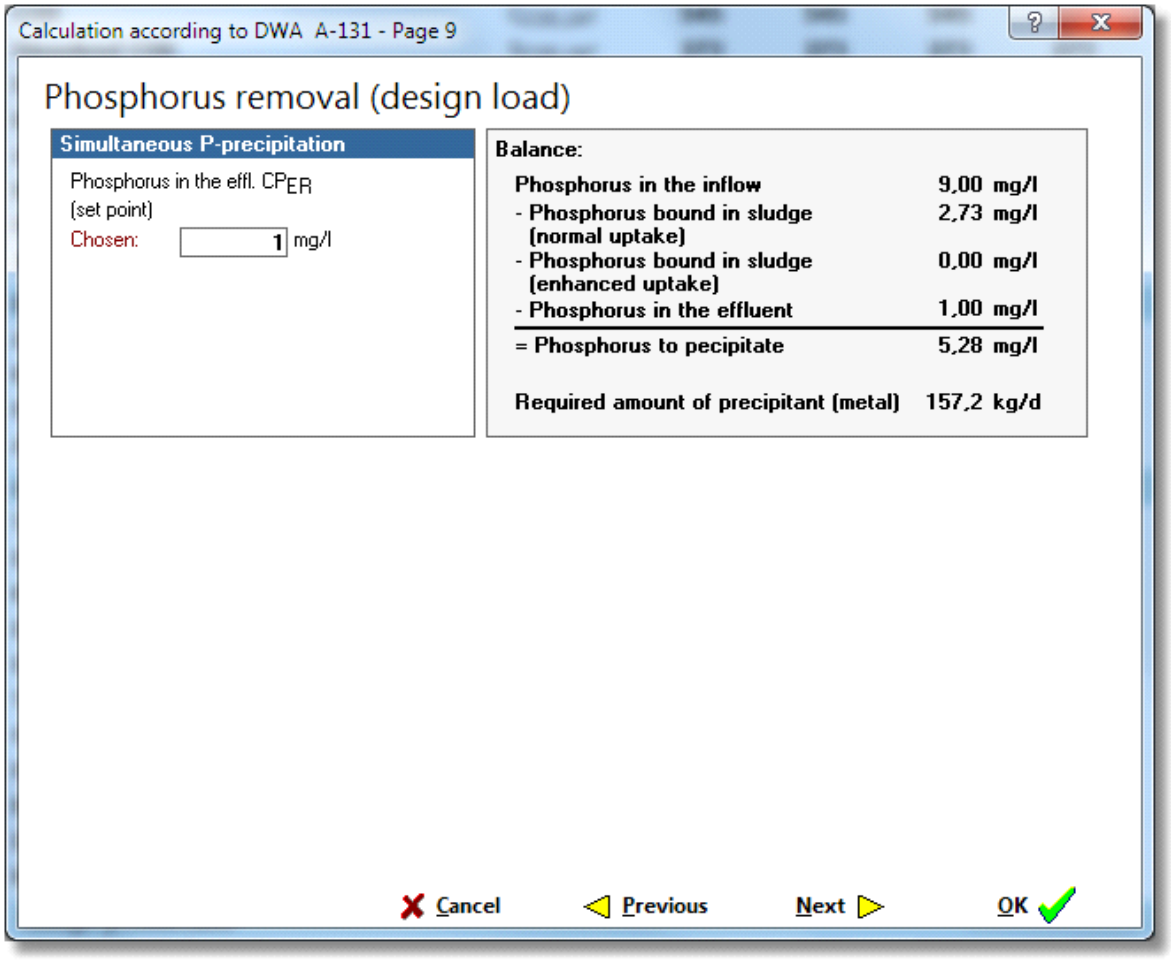
For the load case "Minimum oxygen demand", an additional input field for a reduction factor fZ is available. If you enter a 1 here as shown above, the minimum sag according to A131 is calculated using the endogenous share (formula 63). Otherwise the factor entered is used.

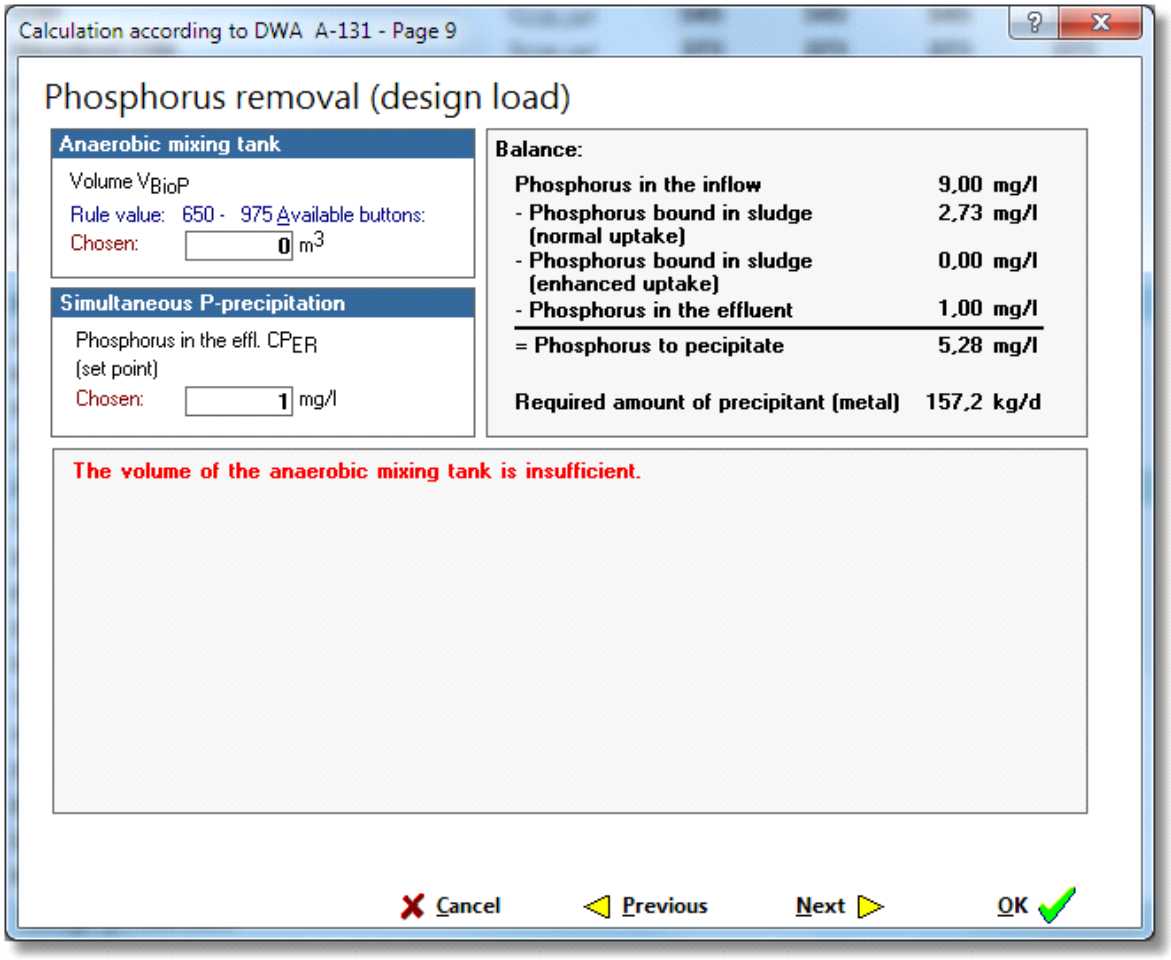
The input fields for peak factors are not available for the load cases "Mean oxygen demand" and "Minimal oxygen demand" as they are not applicable for these load cases.
Nitrogen balance
If you have selected a denitrification as a process option, you can make settings and set targets for the denitrification on this page. The result area shows the nitrogen balance and the nitrate discharge concentration achievable. Depending on the denitrification method, the required recirculation, the maximum cycle time or the maximum inflow proportion for the last stage of a cascade are also displayed.



Phosphorus elimination

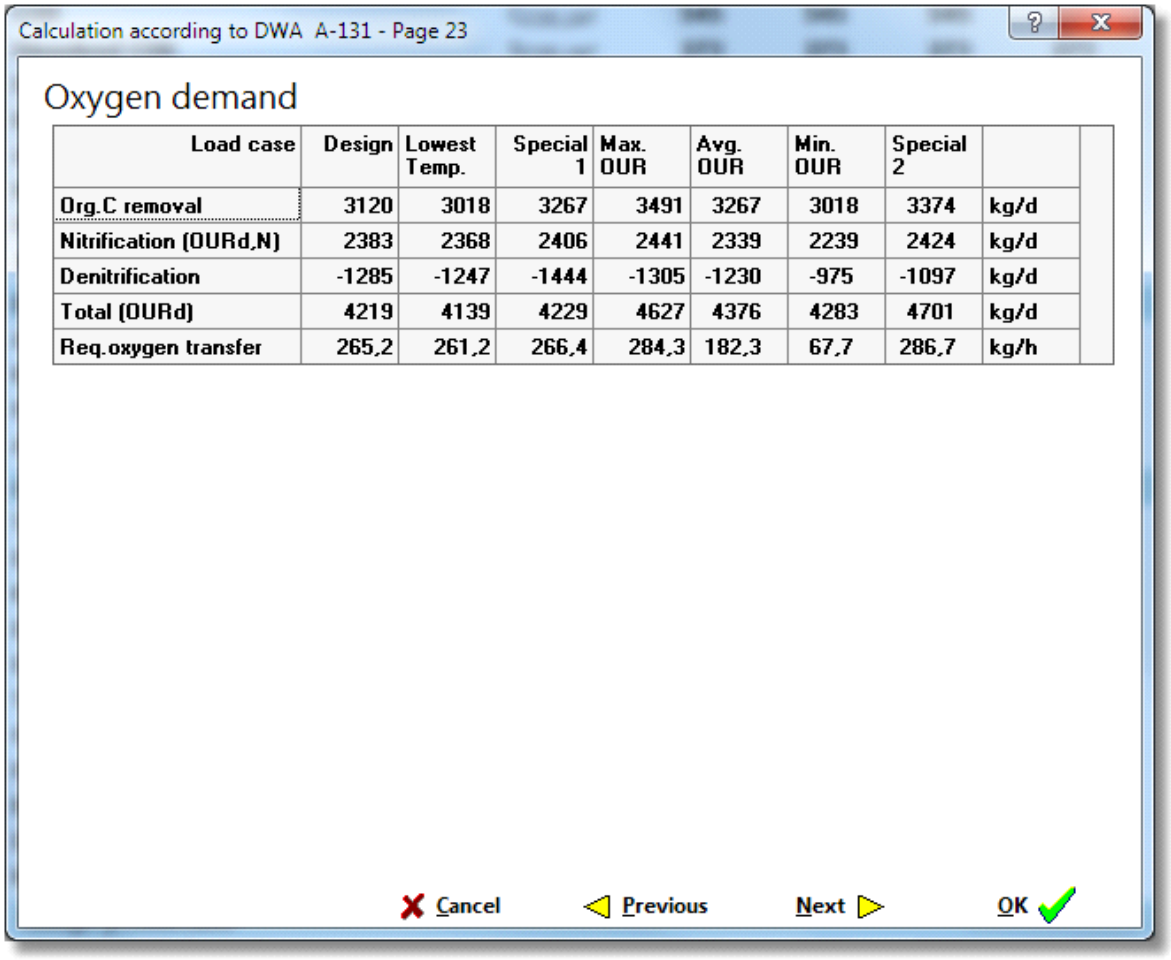
Depending on the requirements for phosphate precipitation and an anaerobic mixing tank, this page contains input fields for the specification of this process option or process component. For an anaerobic mixing tank the volume, for the simultaneous phosphorus precipitation the desired phosphorus concentration in the effluent is to be entered. The amount of precipitant required for simultaneous precipitation is given in relation to the precipitant metal. The guidance levels for the volume of an anaerobic mixing tank are based on a contact time of 0.5 to 0.75 h with dry weather flow and a return sludge ratio RS = 1.


Calculation according to DWA A-131 - Page 9
Phosphorus removal (design load)
Simultaneous P-precipitation
Phosphorus in the effl. CP_{ER}
(set point)
Chosen: 1 mg/l
Balance:
Phosphorus in the inflow 9,00 mg/l
- Phosphorus bound in sludge (normal uptake) 2,73 mg/l
- Phosphorus bound in sludge (enhanced uptake) 0,00 mg/l
- Phosphorus in the effluent 1,00 mg/l
= Phosphorus to pecipitate 5,28 mg/l
Required amount of precipitant (metal) 157,2 kg/d
Cancel
Previous
Next
OK



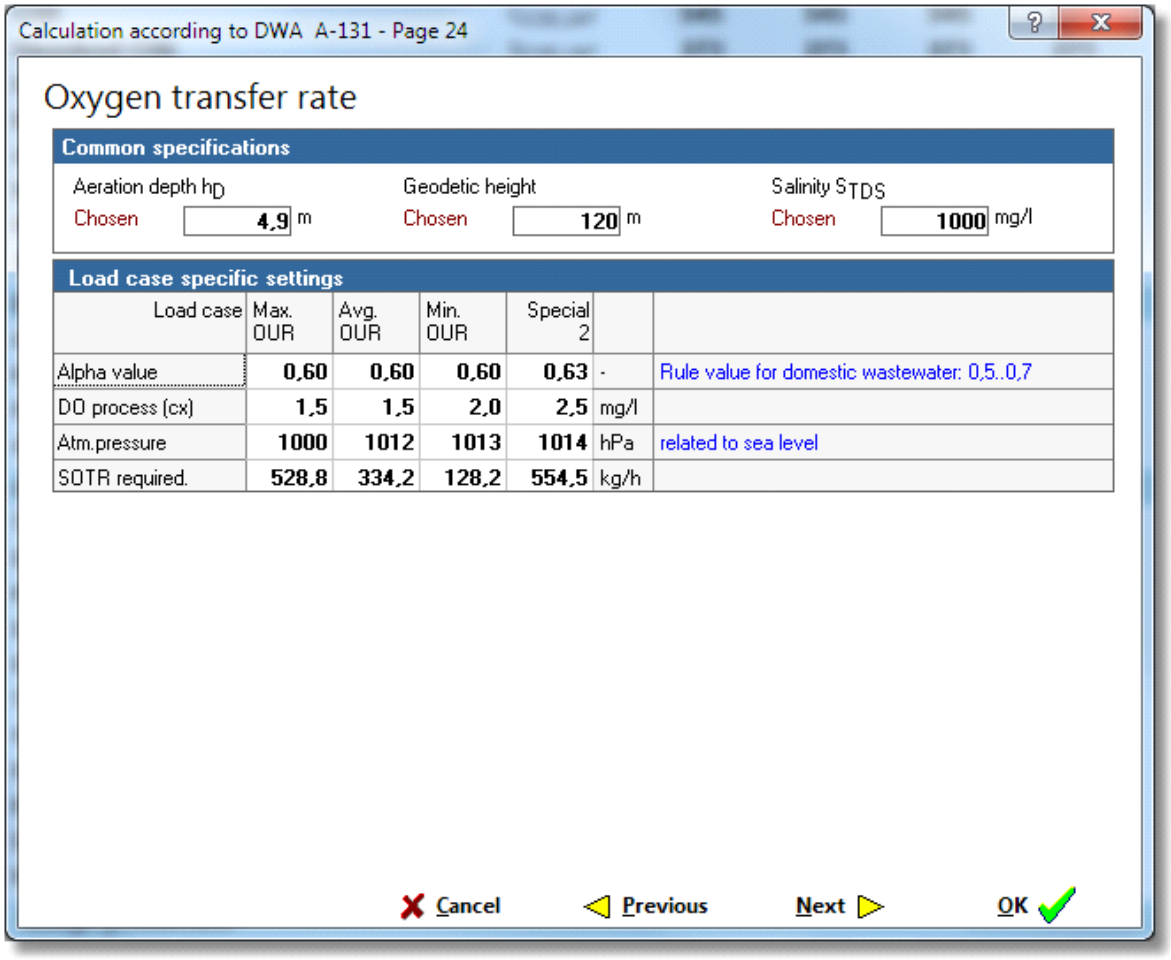
Oxygen demand

A summary of the oxygen demand for the individual load cases is shown here in the form of a table. The values for the mean and minimum oxygen demand as well as the special load case 2 are only calculated by the combi-version of the program.
In case of process-related intermittent operation of the aeration, the time factor "fint" is already taken into account in the peak demand values OUh



Oxygen transfer

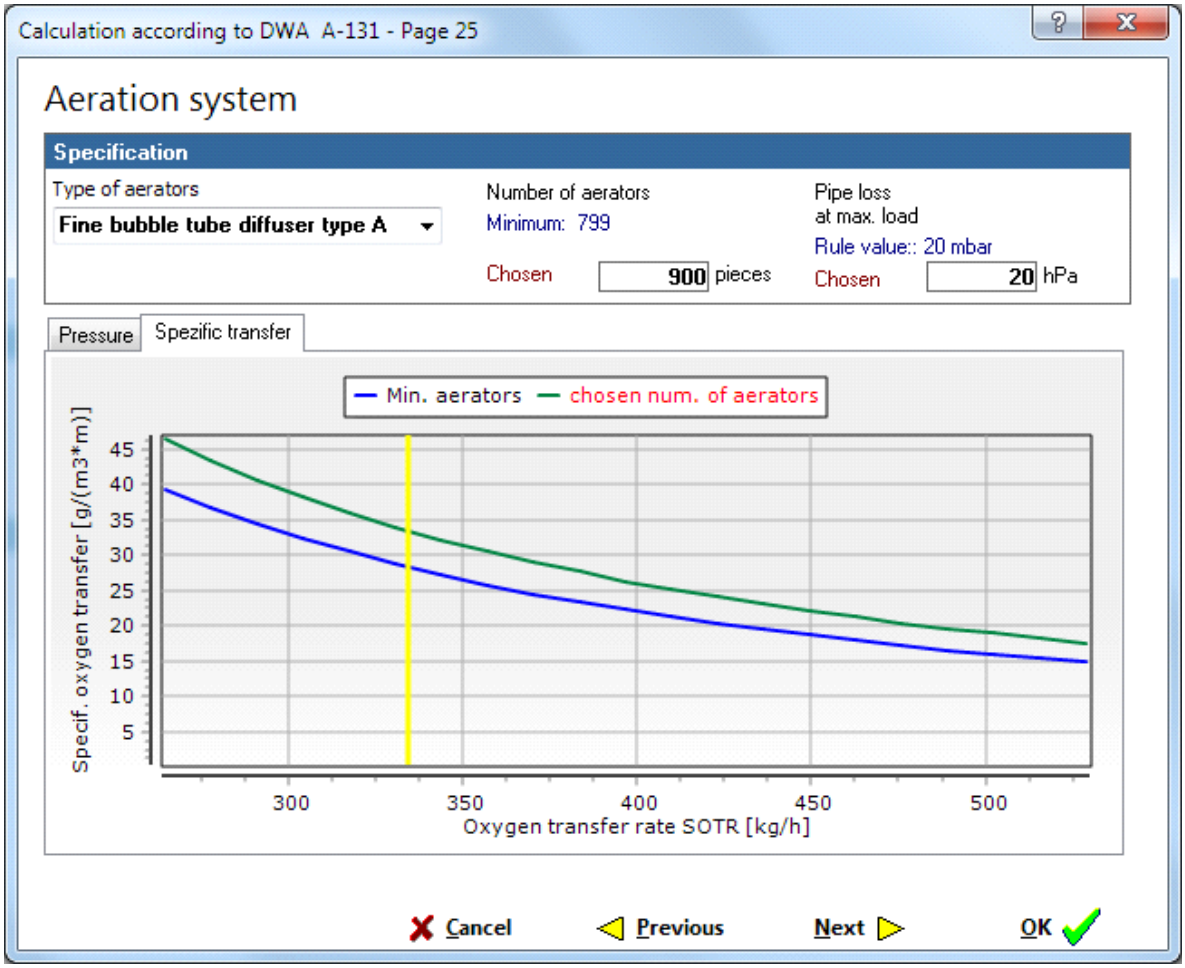
In the combi-version, ACTIVATED SLUDGE EXPERT makes it possible to calculate a diffused aeration. Here, the required oxygen transfer rate is calculated individually for each activated load case. The load case "Maximum oxygen demand" always has to be activated. The alpha value, the desired oxygen concentration in the activated sludge (cx) and the atmospheric pressure are to be entered as the data specific to the load case. The respective oxygen demand is taken from the calculation of the activated sludge tank. The following are also required as values which apply to all load cases: the aeration depth, the altitude of the installation site and the salinity. The oxygen transfer rate calculated with these input values is shown in the bottom line of the table. You can overwrite this value if necessary.



Aeration system

Within the framework of the specification of the aeration system you can select a certain aerator from the group of predefined aerators. Based on the characteristics of the aerator thus determined (e.g., maximum load in normal operation), a required number is calculated. For the minimum and the selected number, the specific oxygen transfer rate (SSOTR) is shown as a graph in dependence on the absolute transfer rate (SOTR). A further diagram on a second tab page shows the relationship between oxygen transfer rate SOTR and pressure difference (at the blower outlet). The specified pipe loss is taken into account here.

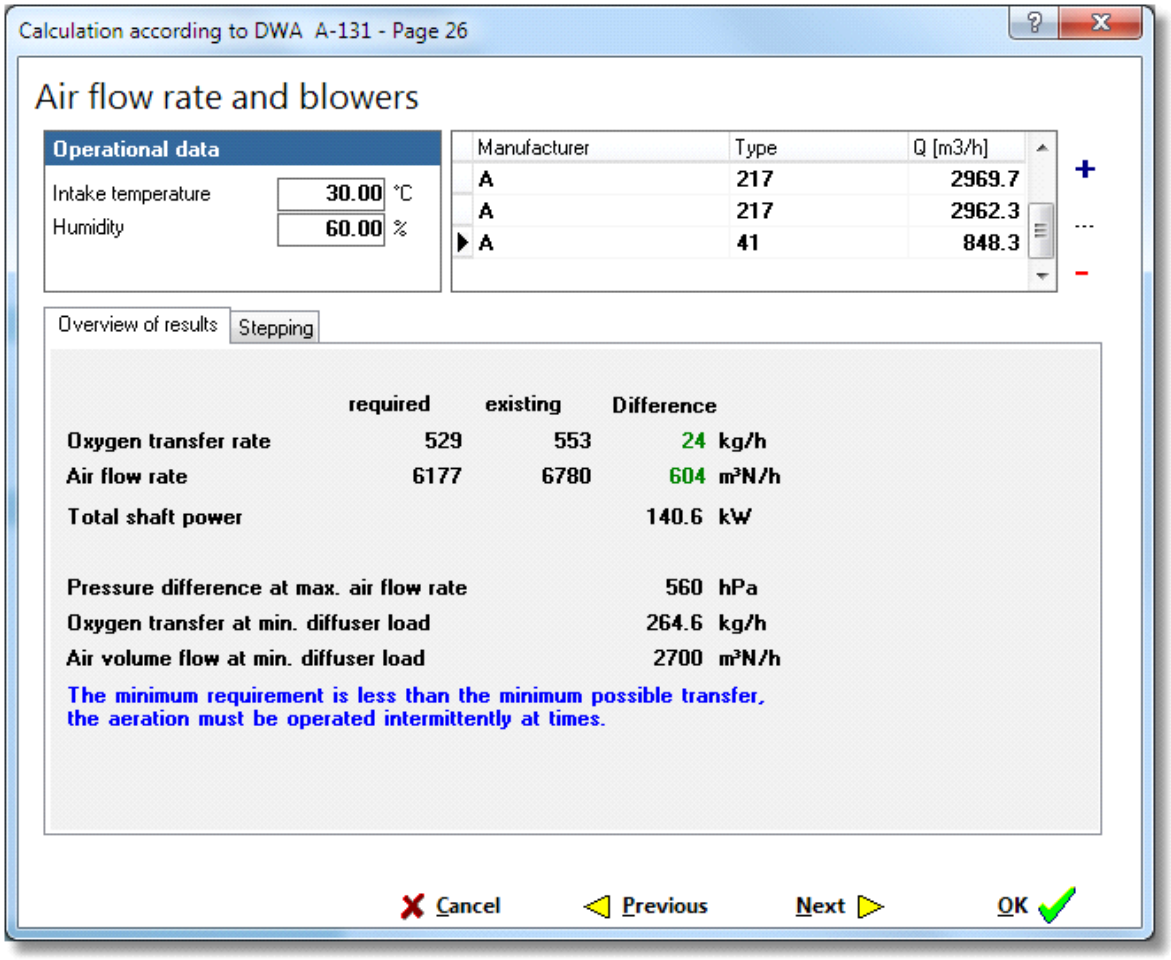
The yellow, vertical lines mark the mean oxygen transfer rate in both diagrams.

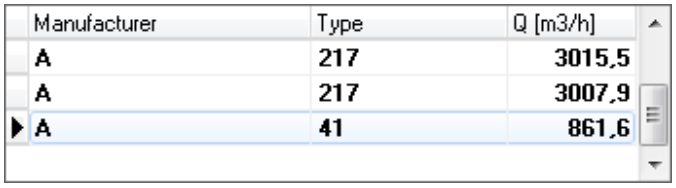


You have the option to define further aerators. For details, see Chapter 8

Blowers

On page 26 "Air flow rate and blowers", a blower constellation can be put together and evaluated, taking operating data into account. As operating data, you enter the intake temperature and the relative humidity of the air . The selected blower constellation is shown in the table to the right of these input fields.





By clicking on the buttons to the right of the table, you can add a blower to the current configuration (button +), remove the selected blower from the configuration (button -) or change blower-specific data (rotation speed, efficiency,...) (button ...). The selected blower is marked in the table by an arrow symbol on the left edge of the table.

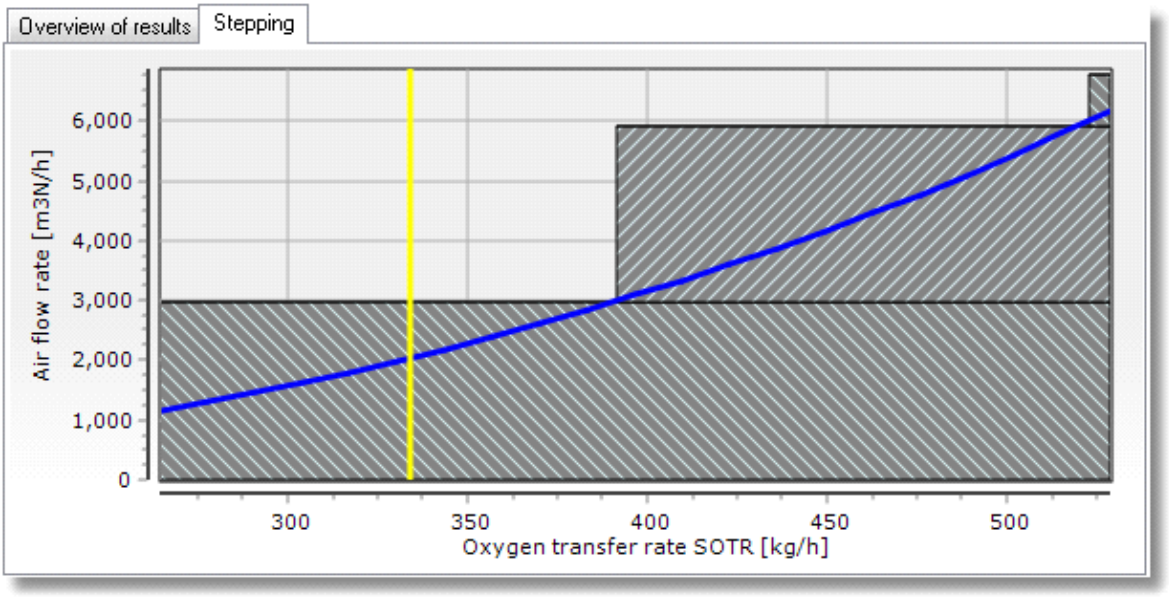
Adding a blower

Before adding a blower, it is recommended to select the "Overview of results" tab in the result area, as the air requirement still to be covered is shown as a numerical value on this page.

After clicking on the button + a dialogue window appears with a table of all the blowers defined in the program. These are machines available in Germany. They have been "anonymised" at the request of the DWA Specialist Committee.

Select a blower by clicking on the corresponding line (or move the marker arrow on the left there using the cursor keys) and then on click "Add". The flow rates Q shown in the table are the airflow rates that the blowers would convey at their current operating conditions entered (intake temperature, differential pressure, etc.) and at their maximum speed as specified by the manufacturer. Compare these airflow rates with the air requirement still to be covered in order to make a suitable selection. 1

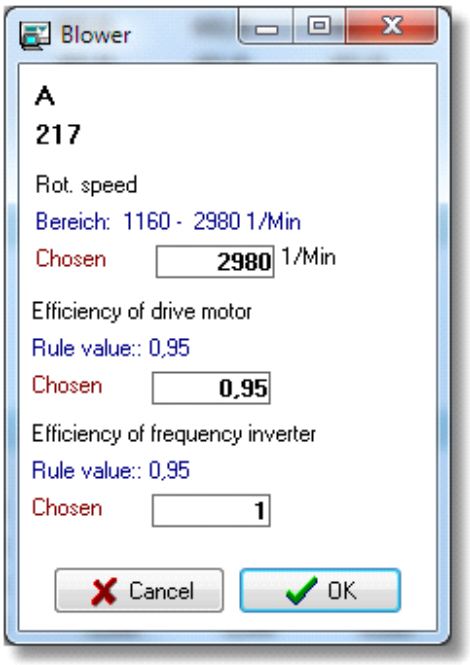
Blowers added are always put at the bottom of the list. The order may be important, since the program assumes that in case of varying air requirements, the blowers are switched on or off in the order shown in the table. A "base load blower" should therefore always be entered first.
The blower grading can be judged on the basis of the diagram on the tab page "Grading" in the result area. The blue curve represents the relationship between oxygenation capacity and air requirements. The vertical yellow line again marks the mean oxygenation capacity. In order to avoid excessive switching frequency, blower application points should preferably not be in an area that is frequently passed in normal operation. However, this criterion is less important when using frequency converters.



Changing blower specific data

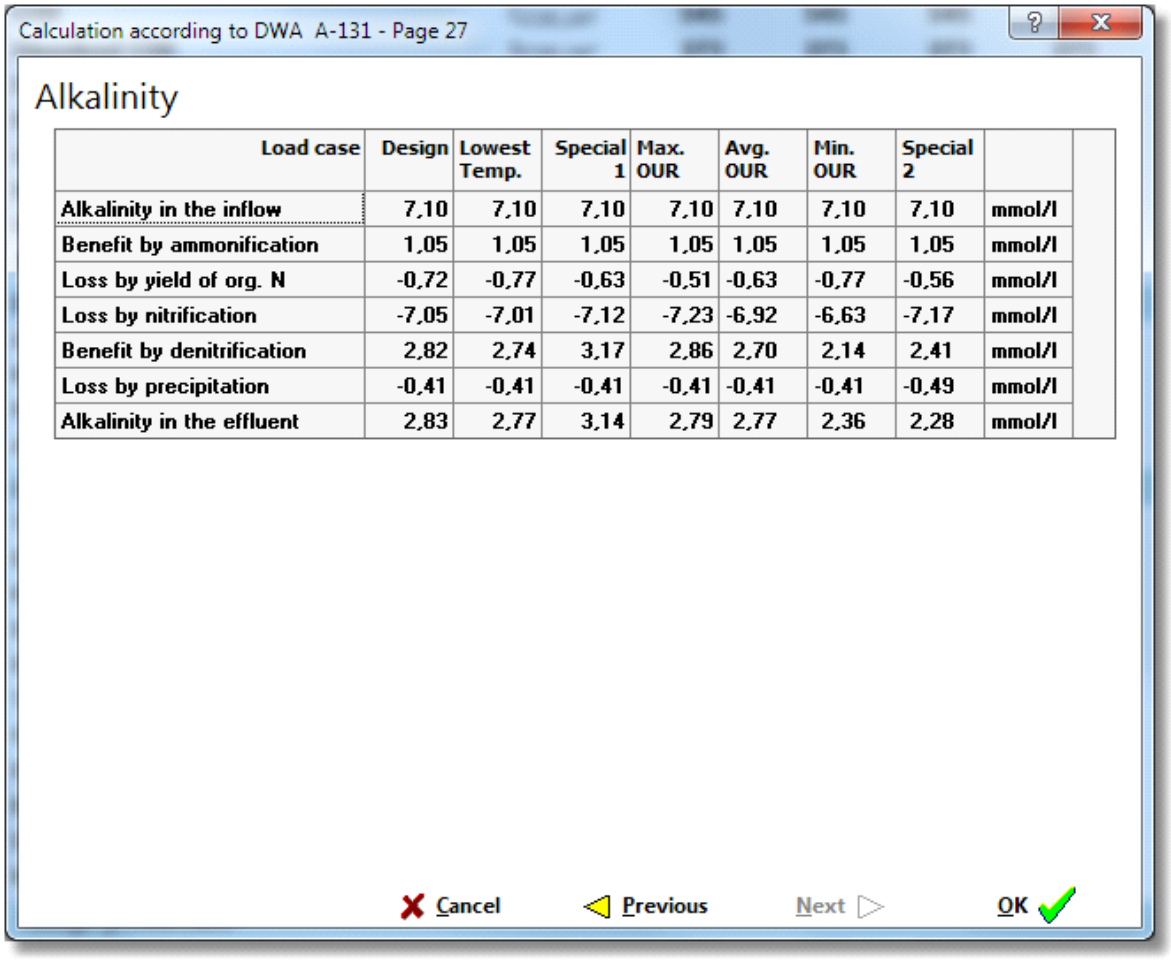
In the aforementioned selection list, the airflow rates are specified for the maximum speed of the blower. In practice, the blowers are often supplied or operated at different speeds. It is therefore possible to change the speed of the blower individually within the limits specified by the manufacturer. In addition, the efficiencies of the drive motor and, if applicable, a frequency converter can be defined.
When adding a blower to the blower configuration, standard values are set:
Rotation speed: maximum speed as specified by the manufacturer
Internal pressure loss: 20 hPa
Efficiency of the drive motor: 0.95
Efficiency of the frequency converter: 1.0 (the value "1.0" means there is no converter available)

To edit this data, first select a blower as described and then click on ...
A small dialogue window with several input fields then appears in which you can enter the desired data. If you close this window with "OK", the data for the selected blower is accepted and the flow rate and the power consumption is recalculated. By clicking "Cancel", the blower-specific data remains unchanged.



Alkalinity

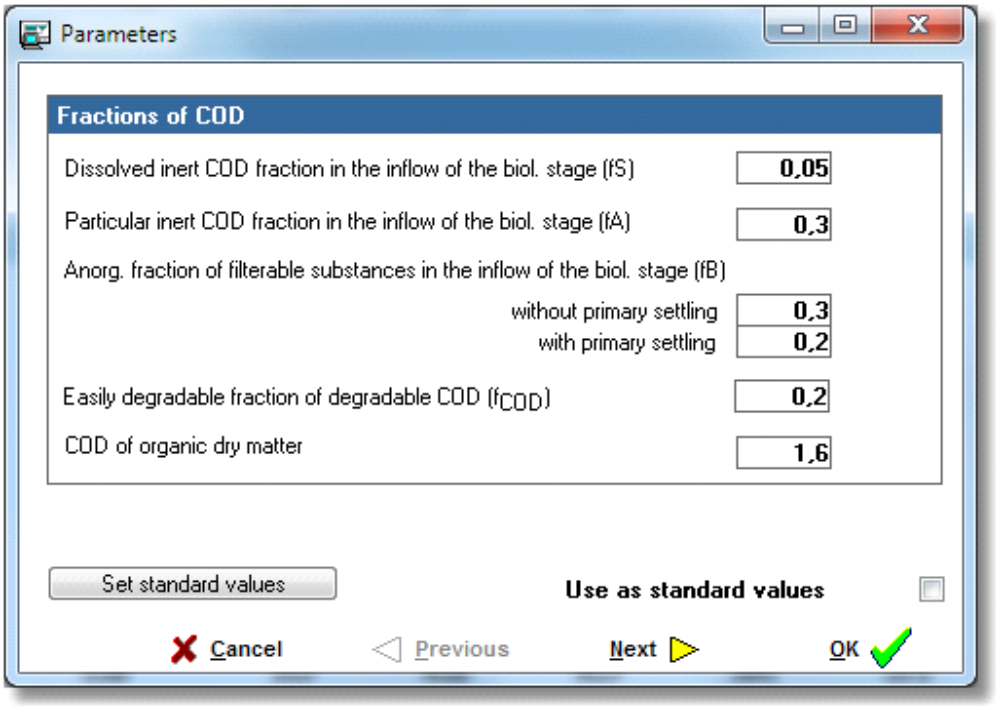
On the last page of the main input dialogue, a balance of the acid capacity is displayed for each load case calculated. No entries are required here.

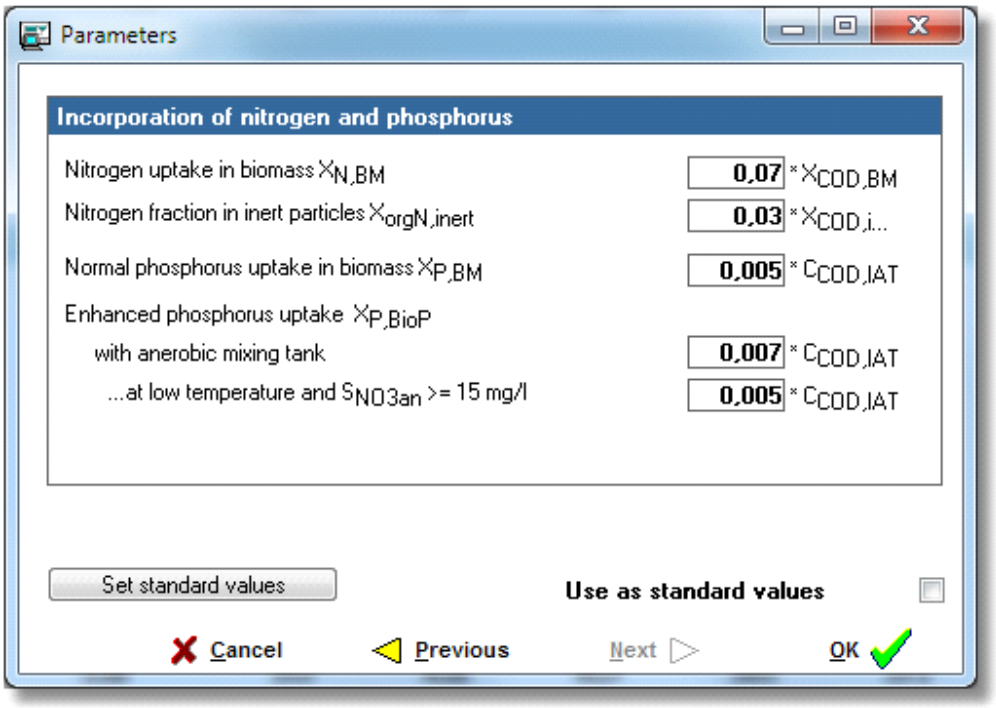


Load case	Design	Lowest Temp.	Special 1	Max. OUR	Avg. OUR	Min. OUR	Special 2	
Alkalinity in the inflow	7,10	7,10	7,10	7,10	7,10	7,10	7,10	mmol/l
Benefit by ammonification	1,05	1,05	1,05	1,05	1,05	1,05	1,05	mmol/l
Loss by yield of org. N	-0,72	-0,77	-0,63	-0,51	-0,63	-0,77	-0,56	mmol/l
Loss by nitrification	-7,05	-7,01	-7,12	-7,23	-6,92	-6,63	-7,17	mmol/l
Benefit by denitrification	2,82	2,74	3,17	2,86	2,70	2,14	2,41	mmol/l
Loss by precipitation	-0,41	-0,41	-0,41	-0,41	-0,41	-0,41	-0,49	mmol/l
Alkalinity in the effluent	2,83	2,77	3,14	2,79	2,77	2,36	2,28	mmol/l

Parameters of the Calculation Model

Via the menu function Edit | Parameters a dialog window appears for changing the parameters defined in worksheet A 131 for nitrogen and phosphorus incorporation in biomass and for COD fractionation:





The handling of the input fields corresponds to the main input dialog. If you activate the check box "Use as default values", the entered parameter values become valid for the current calculations as well as for all new calculations created subsequently when you close the dialog with "OK". Otherwise they will only be taken over into the current calculation. With "Cancel" you close the dialog without data transfer.

Aerator data

In the combined version of ACTIVATED SLUDGE EXPERT aerators or diffusers are defined by the following data:
Designation
Design (alternatives: pipe, disk or dome, small panel, large panel, hose),
Material (alternatives: EPDM, silicone, polyurethane, rigid porous plastic, ceramics)
Geometric data (depending on design):
- Length
- Width
- Diameter

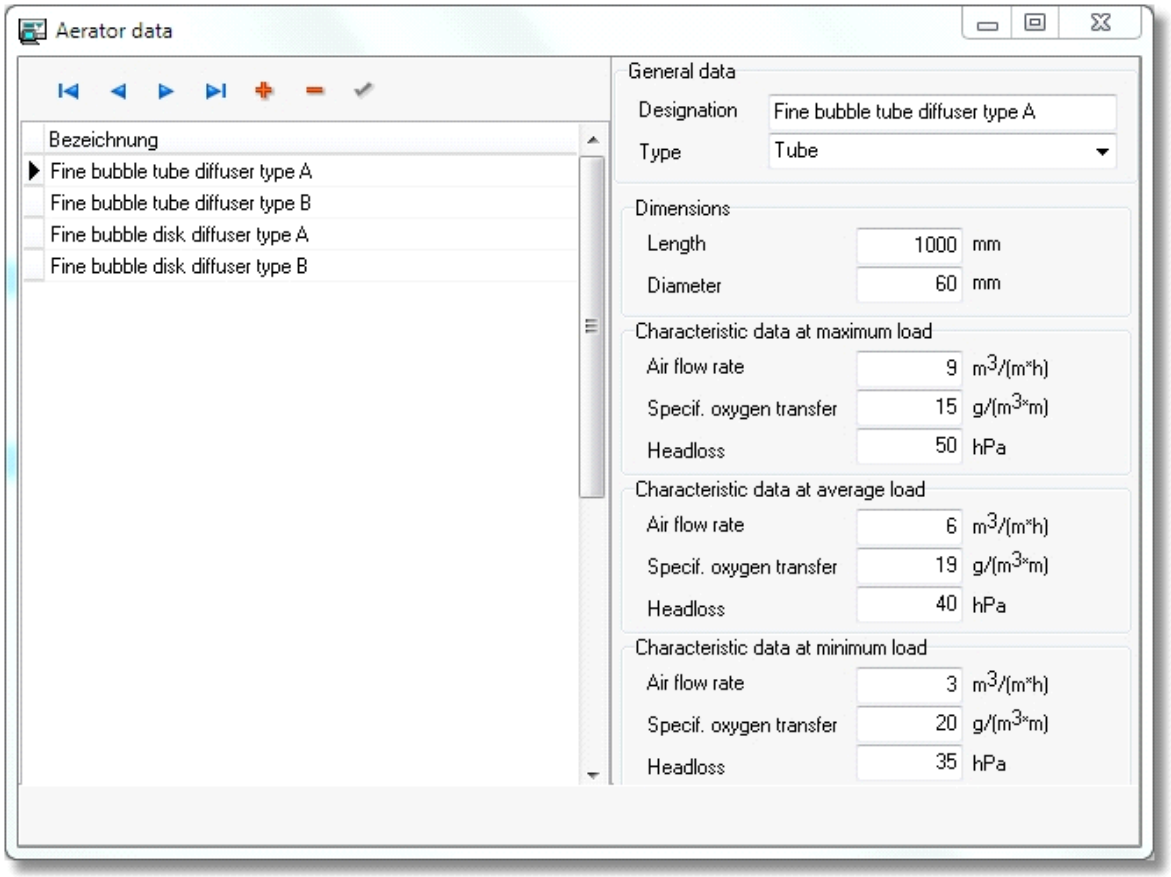
Maximum, mean and minimum load with assigned values for specific oxygen input and pressure drop:
- qMAX: Maximum permissible diffuser load in normal operation
- ssotrMAX: Specific oxygen transfer rate at qMAX
- dpMAX: Pressure loss with qMAX

- qMIN: Minimum permissible diffuser load in normal operation
- ssotrMIN: Specific oxygen transfer rate at qMIN
- dpMIN: Pressure loss with qMIN

- qAVG: Average diffuser load
- ssotrAVG: Specific oxygen transfer rate with qAVG
- dpAVG: Pressure loss with qAVG

These data have been derived from measurement results for the predefined aerators.
Otherwise, they can generally be taken from the documentation of the aerator manufacturer.
The loads qMAX, qMIN and qAVG are defined as follows:
for tube and hose aerators as standard air volume flow per m length and hour [m3/(m*h)].
for plate, dome and small panel aerators as standard air volume flow per piece and hour [m3/(pcs*h)].
for large panel aerators as standard air volume flow per m2 surface area and hour [m3/(m2*h)].

To edit the aerator data, call the function "Edit | Aerator data" from the main menu. The following dialog window then appears:



In the left part you see a list with the names of all defined aerators. On the right side the characteristics of the currently selected aerator are shown. You can change these data directly in the corresponding input fields. The changes are transferred to the aerator file when you close the dialog or switch to another aerator within the dialog or by clicking the button ✓ in the control bar above the table.

Define new aerators

To define a new aerator, click on the button + in the control bar. An empty row will then be created in the identifier table. First enter a name in this line. Then enter the characteristic data for the new aerator in the input fields on the right. When you have finished, click on ✓ to transfer the new aerator to the aerator file.

Delete aerator definition

To delete an aerator definition, first select the aerator in question by clicking on its name in the list or by placing the selection arrow in the corresponding line using the cursor keys. Then click on − in the control bar and confirm the query "Delete data ... ?", which then appears as a precaution, with "OK".

Data export

With the help of the export function, the input values and results can be written to a file. This makes it possible to process ACTIVATED SLUDGE EXPERT data with other programs. The mode of operation largely corresponds to the print function. So templates are also used for the data export, which can be changed or exchanged by the user if necessary. Data export and print output can thus be configured within wide limits. Details on the creation or modification of templates are described in the chapter "Customizing the output of results". The "Standard.gxt" template is included in the standard scope of delivery. An export using this template provides a file that largely corresponds to the print output via the "Standard.gpt" print

template.

Customizing the output of results

The program uses template files for output to the screen and printer (see chapter File menu). In the following, the output of the result report is referred to as a report. It is carried out via a so-called report generator, which interprets the instructions contained in the template files regarding format and content of the result report and creates the actual output accordingly.
The file extension ".gst" is used for screen templates, ".gpt" for print templates and ".gxt" for export templates. All files are in HTML format. HTML means Hypertext Markup Language and is a page description language. It consists of instructions as to where and in what format something should be arranged on a page. The format is standard for the exchange of information on the Internet.
Since HTML files are pure text files, they can be viewed and modified with any text editor such as Notepad. However, users without HTML experience are recommended to use "normal" word processing programs to create and edit such files. All common Office programs support saving the entered data as HTML files. Thus, an individual design of the template files is easily possible without HTML knowledge. Experienced users will probably use a special "HTML editor" for an effective use of the HTML format. HTML editors are part of Internet browsers and are also available separately from various providers.

The template files essentially contain:

Formatting instructions e.g. for background and font design,
Formatting statements for lists and tables,
Instructions for inserting graphics e.g. for logos, diagrams or photos
Instructions for inserting specifications and results of the calculation.

To enable the insertion of input values and calculation results, the program makes them available as variables. The variables are accessible under their names and can be formatted in individual ways.

Basic functions

In the case of a numeric variable, the value is inserted in the output text by writing the variable name, the desired number of digits, and the number of decimal places in the template. To mark the whole thing as an insertion position, it is framed with vertical lines "|".
For example, the character string |QD,5,0| in the template causes the value of the daily dry weather inflow rate (variable name "QD" according to the variable list) to appear in the output with a total of 5 digits and without decimal places.
If it is a text variable, i.e. a variable containing a text as value, the same spelling is used. However, instead of the number of digits and decimal places, a certain part of the text can be selected via the two numerical specifications: The first number after the variable name indicates how many characters of the text are to be output; the second number determines the start position in the text.

Two examples to illustrate this:
The project name is to be output with the variable name "PROJECT". The output should contain a maximum of 40 characters. The template must then contain:

|PROJECT,40,0|

To print the month and year of the calculation, write in the template:

|DATE,7,4|

With the number "7" you achieve that the output covers maximally 7 characters, the "4" causes that the output begins with the fourth character. This means that the day specification contained in the date is skipped.

Advanced functions

Own variables and formulas
The output of values is not limited to the predefined values provided in the variables list. You can also use formulas and define new variables.
Based on the variable output, the syntax is similar: to label the formula concerned, vertical bars are again used to separate it from the rest of the text.
In the following example, the sum of the variables designated as value1 and value2 is to be output:

|value1+value2,6,1|

Value1 and value2 are added together, the sum is printed in 6 columns with one decimal place. The comma as a separator serves to distinguish between the calculation statement and the formatting data.

If you want to use the sum of the values designated several times within the output, it is recommended to create a new variable, e.g. with the name valuesum as follows:

|sum=value1+value2|

In this way, a new variable with the name "sum" is defined. It receives the value of the expression and can then be used in the report as a program-defined variable. ACTIVATED SLUDGE EXPERT does not distinguish between upper and lower case names.

A further example:

|newvar=var*100|

A new variable is defined with the designation "newvar". It receives the value of the expression "var*100" and can then be used. In this way you could, for example, specify the denitrification share VD/V as a percentage instead of as a fraction:

|VDV100=VDV*100|

The variables defined in this way are, of course, only available after loading the relevant template file. Please also make sure that you always assign self-generated variables a value in the manner shown, otherwise the result of the output is not defined.

Calculating

As shown in the examples above, ACTIVATED SLUDGE EXPERT can also perform numerical variable computational functions within report templates. This not only includes the four basic calculating operations, but also the following mathematical functions:

ABS(x) : absolute value of x
INT(x) : nearest integral value of x
SQR(x) : square of x
SQRT(x) : square root of x
SQRT3(x) : third root of x
EXP(x) : e to the power of x
LN(x) : natural logarithm of x
^ : power, e.g. x^y

The functions are written as shown, i.e. with round brackets and enclosed variable names, e.g. with this instruction

|QTint=INT(QT)|

you generate a variable QTint, which contains the value of QT in a rounded form. It is, of course, nevertheless possible to show decimal places in the report (the digits then contain zeros).

Selecting
In certain situations, it may be useful to make the output text dependent on the results of the calculation, or to skip parts of the template in the output. In the following example, a specific text section is only to be treated and output if the denitrification volume is greater than zero. AERATION EXPERT uses the dollar sign $ to define sections that are conditionally output. For this purpose, the conditionally output text is enclosed in dollar signs and a condition for the output is given after the first dollar sign according to the following scheme:

$?value>0:
...
text
...
$

The condition for the output is contained in the sequence ?value>0:, i.e. between the question mark and the colon. If the condition applies, the following content of the report template up to the next $ sign is output. The end character may well be several pages away. Otherwise, this content is skipped.

The somewhat cryptic-sounding character string > results from the HTML language, it means "greater than". As a further comparative operator, the sequence < ("less than") and the equals sign are available. In the above example, a variable named "value" is queried as "greater than 0".

The following example deliberately shows a more extensive section from a report template so as to demonstrate the use of the HTML language at the same time. In the given case, a complete table with five lines <TR> ... </TR> is created with the so-called "Tags" <TABLE> ... </TABLE>. Each line contains four columns <TD> ... </TD>, here with widths of 60 %, 20 %, 10 % and 10 % of the total table width. The initial condition $?VD>0: means that the whole table is only output if the denitrification volume VD is greater than zero.

$?VD>0:

```
<TABLE CELLSPACING=0 BORDER=0 CELLPADDING=2 WIDTH=640>
 <TR VALIGN="TOP">
  <TD WIDTH="60%">zu denitrifizierendes Nitrat</TD>
  <TD WIDTH="20%" ALIGN="RIGHT">S<SUB>NO3,D</SUB></TD>
  <TD WIDTH="10%" ALIGN="RIGHT">|SNO3D0,6,1|</TD>
  <TD WIDTH="10%">mg/l</TD>
 </TR>
 <TR VALIGN="TOP">
  <TD WIDTH="60%">erforderliche Denitrifikationskapazit&auml;t</TD>
  <TD WIDTH="20%" ALIGN="RIGHT">S<SUB>NO3,D</SUB>/C<SUB>BSB</SUB></TD>
  <TD WIDTH="10%" ALIGN="RIGHT">|SNO3D0/CBSBZB,6,3|</TD>
  <TD WIDTH="10%">kg/kg</TD>
 </TR>
 <TR VALIGN="TOP">
  <TD WIDTH="60%">Gew&auml;hlter Denitrifikationsanteil</TD>
  <TD WIDTH="20%" ALIGN="RIGHT">V<SUB>D</SUB>/V<SUB>BB</SUB></TD>
  <TD WIDTH="10%" ALIGN="RIGHT">|VDV,6,2|</TD>
  <TD WIDTH="10%">-</TD>
 </TR>
 <TR VALIGN="TOP">
  <TD WIDTH="60%">vorhandene Denitrifikationskapazit&auml;t</TD>
  <TD WIDTH="20%" ALIGN="RIGHT">S<SUB>NO3,D</SUB>/C<SUB>BSB</SUB></TD>
  <TD WIDTH="10%" ALIGN="RIGHT">|SNO3D/CBSBZB,6,3|</TD>
  <TD WIDTH="10%">kg/kg</TD>
 </TR>
 <TR VALIGN="TOP">
  <TD WIDTH="60%">denitrifiziertes Nitrat</TD>
  <TD WIDTH="20%" ALIGN="RIGHT">S<SUB>NO3,D</SUB></TD>
  <TD WIDTH="10%" ALIGN="RIGHT">|SNO3D,6,1|</TD>
  <TD WIDTH="10%">mg/l</TD>
 </TR>
</TABLE>
$
```

Special functions in screen templates

Screen templates differ from print templates mainly in that links (references) can also be used meaningfully in screen templates. The menu.htm file contained in the standard.gst screen template gives an example of how to use these links to call up the input dialog (see below: "Show input dialog").

Links
In the above example there are connections between entries in the navigation bar (e.g. rated load) and corresponding pages of the input dialog. Such links are indicated by the mouse pointer turning into a hand symbol. A distinction is made between internal and external links.

Internal links
Internal links allow you to call certain program functions. In addition to the input dialog already mentioned, ACTIVATED SLUDGE EXPERT provides the following functions:

Load file
Save data to file
Loading a Print Template
Printing the Results of a Calculation
Perform calculation

Specifically, these functions are called in HTML statements as follows:

Load file
<A HREF="FILEOPEN filename">

Save data to file
<A HREF="FILESAVE filename">

Load print template
<A HREF="PRINTTEMPLATE filename">

In all of the above statements, "filename" stands for a complete file name (with path).

Print results
<A HREF="FILEPRINT">

Perform calculation
<A HREF="CALCULATE">

Display input dialog:
<A HREF="EDITDLG x"> where x stands for the page number with which the input dialog should appear.

External links
Using so-called external links, you can also call up Internet pages from screen templates and send e-mails.

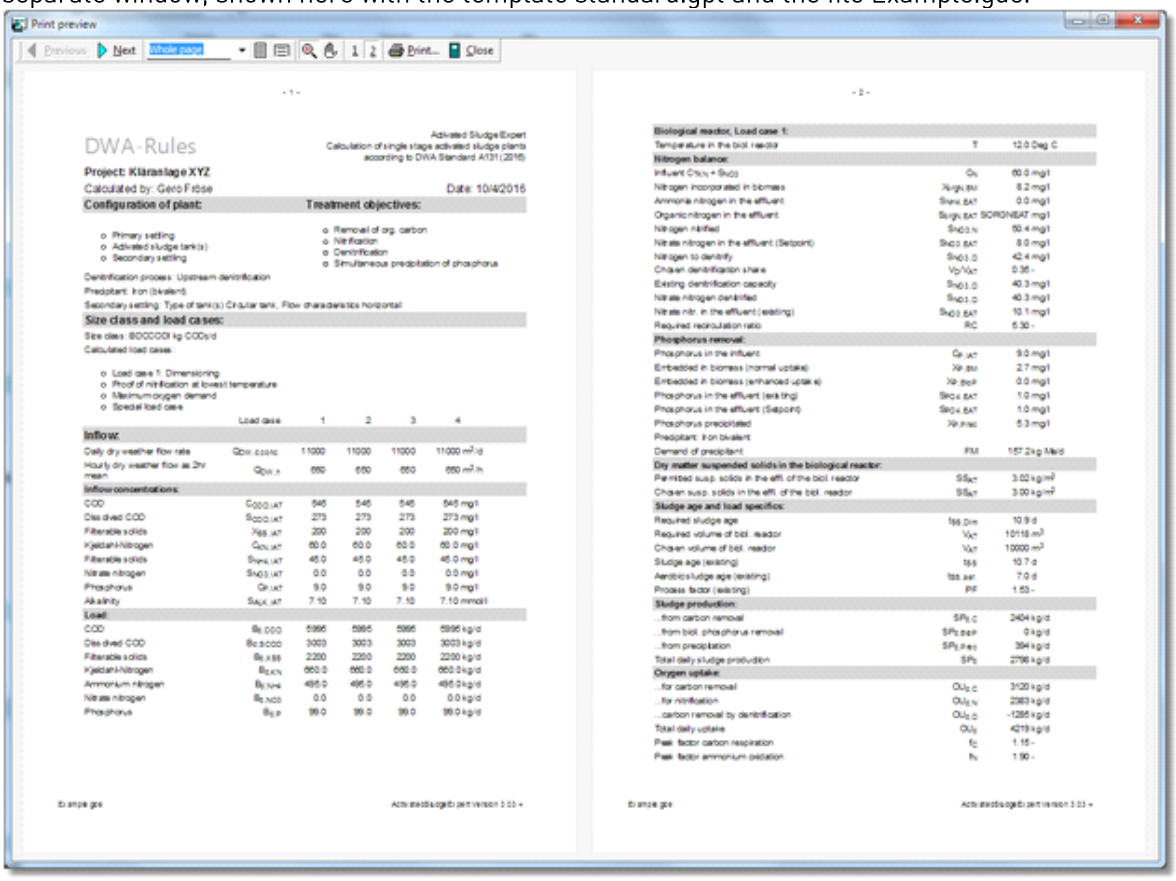
Calling a WWW page on the Internet (example):
<A HREF="http://www.software.gfroese.de">

Link to an email address (example):
<A HREF="mailto:info@gfroese.de">

Examples for the use of external links can also be found in the file Menu.htm.

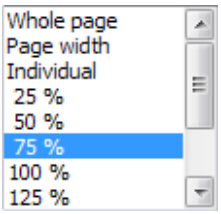
Print preview

The menu Print preview activates the page break in a transition window Print status and then opens a separate window, shown here with the template standard.gpt and the file Example.gde.



The buttons are self-explanatory and surely known from other Windows programs, so only a brief overview is provided here.

Scroll through the Print preview
With the buttons "Back" and "Next" you can scroll through the output page by page.
Change the view
You can change the view using the Selection list or the adjacent buttons.



 Selection view "Whole page" and "Page width"

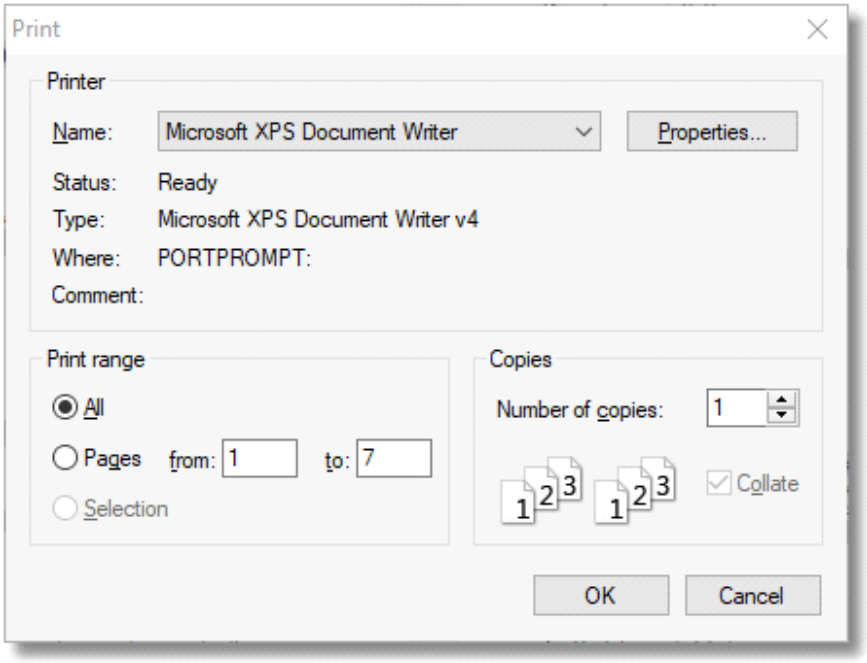
 Select a zoom level. The left mouse button enlarges the view, the right mouse button reduces it.

 Activating the "Hand" allows you to move the area displayed ("Panning").

Start printing
The "Print" button opens the dialogue for printing the results.

End the Print preview
By clicking on the button "Close" or pressing the ESC key, you end the Print preview and return to the main screen of ACTIVATED SLUDGE EXPERT.

Printing
The print output from the main menu, the symbol bar or from the print preview starts with the Windows standard dialog Print. The options that can be set depend on the selected printer. All other settings are functions of the operating system.



List of variables

(All entries in the format variable name: explanation)

General variables:

Project	Designation of the project
Author	Name of the author or revisor of calculation
Date	Calculation date
Active	Code for load case activation (0=load case not calculated, 1 = load case calculated)
LNO	Load case number (0=design, 1=lowest temp., 2= maximum oxygen demand temp.,
	3=special load case process, 4=mean oxygen demand, 5=minimum oxygen demand,
	6=special load case aeration)
LDESIG	Designation of load case
TO	Code cleaning target (1=org.C-degradation, 3=nitrification, 7=aerobic sludge digestion)
TODESIG	Designation of the treatment target
DN	Code denitrification (0=no denitrification, 1=denitrification)
FS	Code simultaneous precipitation (0=no precipitation, 1=precipitation)
PS	Code primary treatment: (0=not available, 1=available)
MB	Code anaerobic mixing tank: (0=not available, 1=available)
AS	Code aerobic selector: (0=not available, 1=available)
NS	Code anaerobic post-stabilisation: (0=not available, 1=available)
PT	Code precipitant (1=Fe3, 2=Fe2, 3=Al3)
PTDESIG	Designation of precipitant
BDCCODI	Daily COD load of the raw sewage (for assignment to the class size)
_SSAT	Required mixed liquor suspended solids in the aeration tank
_SSEAT	Permitted mixed liquor suspended solids in the outlet of the aeration tank
_TSS	Required sludge age
_TSSA	Required aerobic sludge age
_PF	Required process factor
PF	Existing process factor
VAT	Existing volume of activated sludge tank
_VAT	Required volume of activated sludge tank
NCASC	Number of stages (for cascade denitrification)
VBIOP	Volume an anaerobic mixing tank
VSEL	Volume of an aerobic selector

Wastewater flow rates:

QDWD	Dry weather inflow rate as daily average, used for calculation of concentrations
QDWH	Dry weather inflow rate as daily peak (2h)
QWWH	Storm weather inflow rate

Concentrations in the inflow of the biol. stage:

CCODIAT	Total COD
SCODIAT	Dissolved COD
SCODIIAT	Dissolved inert COD
XCODIIAT	Particulate inert COD
SCODDIAT	Dissolved degradable COD
XCODDIAT	Particulate degradable COD
SCODDOS	COD from external carbon source
XCODIAT	Particulate inert COD
XSSIAT	Filterable substances
XSSIIAT	Filterable inorganic substances
CKNIAT	Kjeldahl-nitrogen
SNH4IAT	Ammonium nitrogen
SNO3IAT	Nitrate nitrogen
CPIAT	Total phosphorus
SAIAT	Alkalinity

Activated sludge tank:

SNH4N	Nitrified nitrogen
SNO3D0	Nitrogen available for denitrification
SNO3DMAX	Maximal denitrifiable nitrogen
SNO3D	Denitrified nitrogen
XPPREC	Precipitated phosphorus
SSAT	Mixed liquor suspended solids in the aeration tank
SSEAT	Mixed liquor suspended solids in the outlet of the aeration tanks
T	Temperature in the aeration tank
TSS	Existing sludge age
TSSa	Existing aerobic sludge age
PF	Existing process factor
MH	Sludge mass from C degradation (without ext. C)
MX	Sludge mass from dosage of ext. C
MI	Sludge mass from accumulation of non-degradable solids
MP	Sludge mass by biol. P removal
MF	Precipitation sludge mass
VDV	Proportional denitrification volume or time
DV	Code denitrification method (1=upstream, 2=cascade, 3=simultaneous,
	4=alternating, 5=intermittent)
DesDV	Designation of the denitrification method
RC	Existing internal recirculation
_RC	Required internal recirculation
_TT	Maximum cycle time (intermittent and alternating denitr.)
_QCASC	Maximum inflow share in the last cascade (cascade denitr.)
RM	Code recirculation via anaerobic mixing tank (0=no, 1=yes)
fC	Peak factor for the carbon respiration
fN	Peak factor for the nitrogen oxidation
cs	Oxygen saturation value
cx	Oxygen concentration

OUC	Oxygen consumption for carbon degradation
OUN	Oxygen consumption for nitrification
OUD	Oxygen consumption for denitrification
OUH	Maximum hourly oxygen consumption (total)
SOTRH	Required hourly oxygen transfer
fZ	Reduction factor for minimal oxygen consumption
fVAT	Proportionally available aeration volume in case of examination
Alpha	Oxygen uptake rate
_SOTR	Required oxygenation capacity in pure water under standard conditions
SOTR	Existing oxygenation capacity in pure water under standard conditions
TDS	salinity
Tamb	Atmospheric temperature
Pamb	Atmospheric pressure
Hum	Relative humidity of the air sucked in by the aerator
MPREC	Required amount of precipitant (related to precipitant-metal) XNBM:
XCODBM	Particulate COD in biomass
XCODIBM	Particulate inert COD in biomass
XNBM	Nitrogen incorporated in biomass
XPBM	Phosphorus incorporated in biomass (normal P uptake)
XPBIOP	Phosphorus incorporated in biomass (enhanced P uptake)

Concentrations in the outlet of the activated sludge tank:

SNH4EAT	Ammonium nitrogen	
SNO3EAT	Nitrate nitrogen	
_SNO3EAT	Nitrate nitrogen (target value)	
SorgNEAT	Organic nitrogen	
SPO4EAT	Phosphate-P	
_SPO4EAT	Phosphate-P (target value)	
SAEAT	Alkalinity	

Secondary settling:

FTYPE	Designation of the flow characteristic
NT	Code tank type (1=circular tank, 2=hopper-bottomed tank, 3=rectangular tank)
NTYPE	Designation of the tank type
QIST	Decisive water quantity
NST	Number of secondary settlement tanks
AST	Existing surface of secondary settling tank
_AST	Required surface of secondary settling tank
ASTEFF	Effective surface of secondary settlement tank
_VST	Required volume of secondary settling tank
QA	Existing surface loading
_QA	Permissible surface loading
QSV	Existing sludge volume surface loading
_QSV	Permissible sludge volume surface loading
SVI	Sludge volume index
TTH	Thickening time

RS	Existing return sludge ratio
_RS	Permissible return sludge ratio
SSRS	Mixed liquor suspended solids in the return sludge
SSBS	Mixed liquor suspended solids at the tank bottom
R2B	Ratio TSRS/TSBS
SSIST	Existing mixed liquor suspended solids in the inlet of the final clarification
_SSIST	Permissible mixed liquor suspended solids in the inlet of the final clarification
QRS	Return sludge flow rate
H1	Depth of clear water zone
H23	Depth of the transition and buffer zone
H4	Depth of thickening and clearing zone
HST	Existing secondary settlement tank depth
_HST	Required secondary settlement tank depth
HIN	Depth of inlet
VIS	Volume of the inlet structure
HSIN	Height of the inlet slit
AIC	Cross-sectional area of the inlet siphon
VIN	flow velocity in the inlet siphon
PIN	Power entered in the inlet structure
GIS	Turbulent shear stress
FD	Densimetric Froude Number

Circular tank:

DST	Existing tank diameter
_DST	Required tank diameter
DCS	Diameter of the central structure

Rectangular tank:

WST	Tank width (at the inlet side)
LST	Existing tank length (in flow direction)
_LST	Required tank length

Hopper-bottomed tank:

HVST	Vertical wall height below water level
DSST	Diameter at the sole
XST	Hopper inclination

Aeration (combi-version only):

DF	Code aerator form (0=pipe, 1=small panel, 2= disk, 3=large panel, 4=hose)
DDESIG	Designation of aerator type
DNAME	Designation of the aerator
qAerMin	Minimum permissible diffuser load in normal operation
qAerMax	Maximum permissible diffuser load in normal operation
nAer	Number of aerators or diffusers
_SOTRmax	Required oxygen transfer rate at maximum oxygen demand
SOTRmax	Existing oxygen transfer rate at maximum oxygen demand
SSOTRmax	Existing specific oxygen transfer rate at maximum oxygen demand
_SOTRmin	Required oxygen transfer rate at minimum oxygen demand
SOTRmin	Existing oxygen transfer rate at minimum oxygen demand
SSOTRmin	Existing oxygen transfer rate at minimum oxygen demand
_SOTRavg	Required oxygen transfer rate at average oxygen demand
SSOTRavg	Existing oxygen transfer rate at average oxygen demand
_QairMax	Required air volume flow at maximum oxygen demand
QairMax	Selected air volume flow at maximum oxygen demand
QairAvg	Air volume flow at mean oxygen demand
QairMin	Air volume flow at minimum oxygen demand
NBL	Number of blowers
HGEO	Altitude
hD	Aeration depth
dPMax	Pipe loss at maximum air volume flow

Blower (combi-version only):

MakeBL	Name of the manufacturer
TypeBL	Designation of the blower
RBL	Rotation speed of the blower
QBL	Delivery rate acc. to data sheet of manufacturer
PBL	Shaft power of the blower
EtaM	Efficiency of the motor
EtaC	Efficiency of the frequency converter

Parameters:

fTh	Temperature factor for growth of heterotrophic organisms
fTa	Temperature factor for growth of autotrophic organisms
fTd	Temperature factor for decay
Bh	Decay rate of heterotrophic organisms
Ya	Yield of autotrophic organisms
Ba	Decay rate of autotrophic organisms
MueaMax	Max. growth rate of autotrophic organisms
kN	Half-value concentration for nitrification
fCOD	Share of readily degradable COD in degradable COD
fCODA	Particulate inert COD fraction in the inlet of the biol. stage
fCODB	Inorganic share in filterable substances (without primary settling)
fCODBPS	Inorganic share in filterable substances (with primary settling)
fCODi	Dissolved inert COD fraction in the inlet of the biol. stage

fCODoSS	COD of the organic dry matter
fXNBM	Factor nitrogen uptake into biomass
fXPBM	Factor "normal" P uptake into biomass
fXPBIOP	Factor enhanced P uptake into biomass (normal case with anerobic mixing tank)
fXPBIOPT	Factor enhanced P uptake into biomass (with anerobic mixing tank, low temp.)
fXPBIOPD	Factor enhanced P uptake into biomass (upstream or casc. Denitr., without mixing tank)