

Manual

cigarettedesigner 4.1

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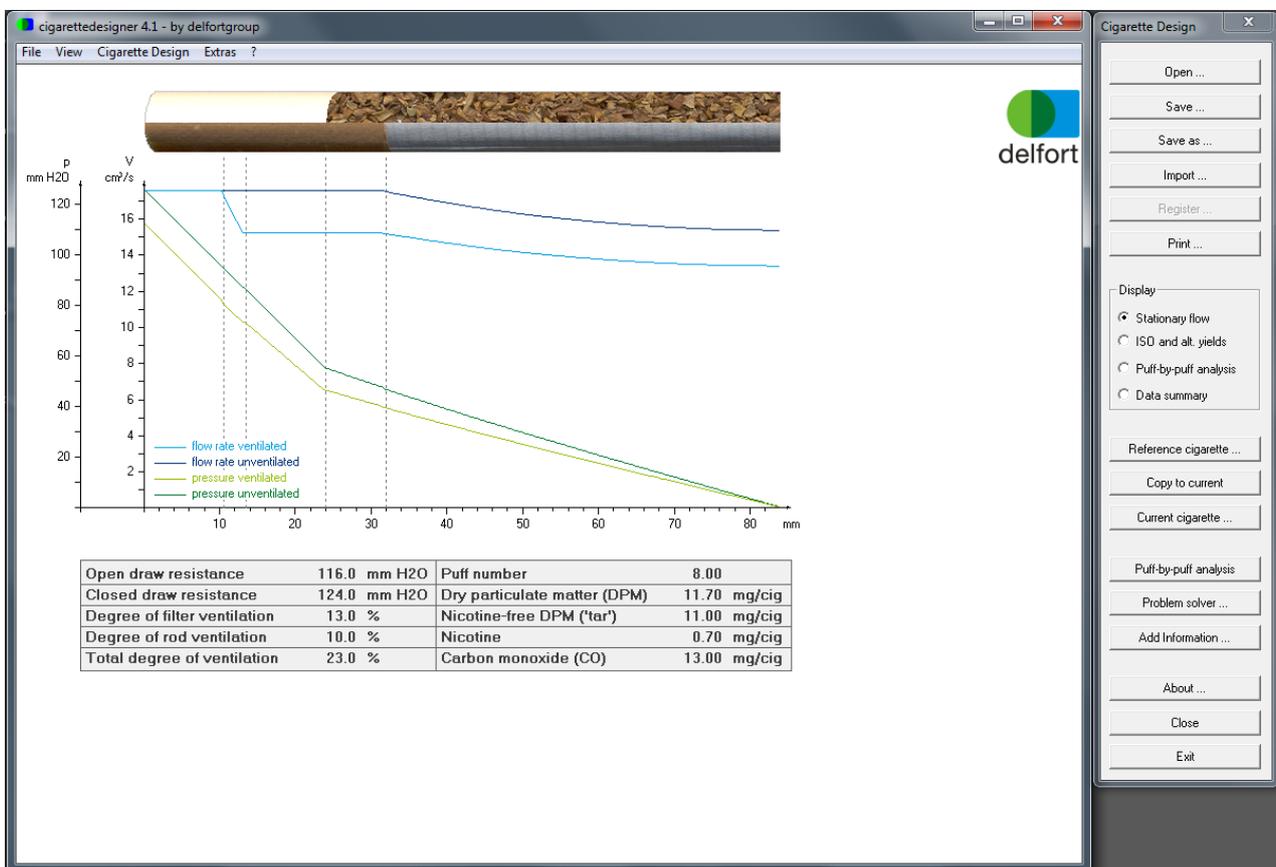


Installing the Software

To install the software double-click on cigarettedesignerZIP.exe to extract the compressed files and then double click on Setup.msi to start the installation process. You will be guided through the installation process and will get the opportunity to choose a directory for the software.

Starting the Software

To start the software double-click on the cigarettedesigner 4.1 icon, or start "cigarettedesigner.exe" from the Explorer by double-clicking. The main window will appear and the menu bar will be displayed on the right hand side of the main window. All functions of the software can be either accessed through the menu or through the menu bar.



Menu: File

Open

Opens a previously saved cigarette design file. Typically the file extension will be ".cig".

Save

Saves the current cigarette design together with the reference cigarette data. You will be asked for a file name if you have not previously saved this design.

Save as

Saves the current cigarette design together with the reference cigarette data. You will be prompted for a file name. The file name will then appear in the title bar of the main window.

Import

Imports files produced with the previous version of the cigarettedesigner software 3.0.

Print

Prints a data summary and the corresponding graphs of your cigarette design. You will be asked for a printer by the standard windows printer dialog.

Register

If your version of the software has not yet been registered, you will only be able to use very limited functionality. By registering you will be connected to www.cigarettedesigner.com via your internet browser and you will receive an activation code by e-mail, which you can enter to activate your software. This activation code allows you to permanently activate the full functionality of the software. The code itself, however, will expire and has to be entered within three days to activate the software. If you are not able to enter the code within three days, simply register again. The registration is free of charge.

Exit

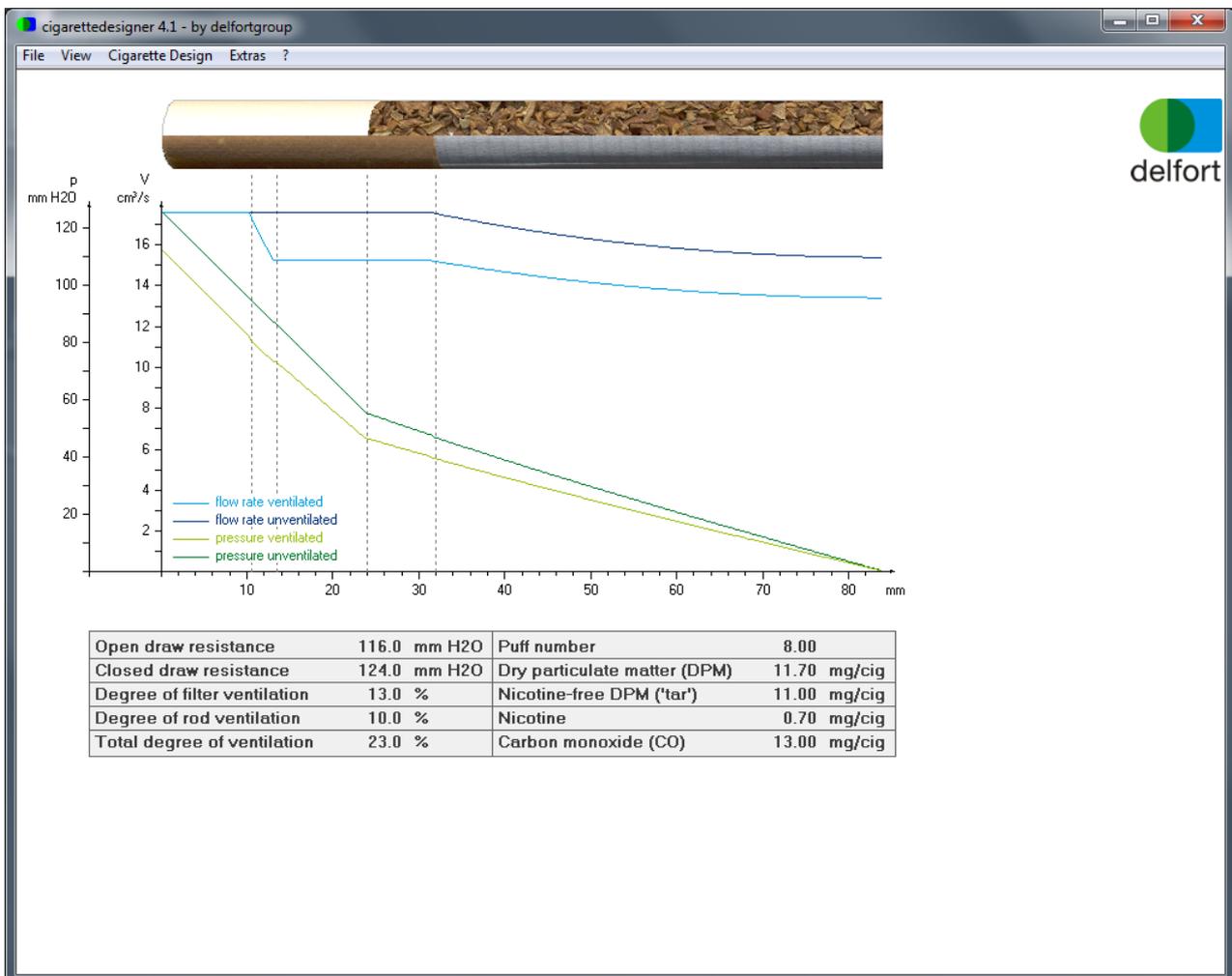
Shuts down the program. You will not be asked to save the cigarette design even if it was modified.

Menu: View

Stationary Flow Results

Displays the simulation results for the stationary flow through the cigarette. A flow of 17.5 cm³/s is assumed at the mouth end and pressure and flow velocity along the cigarette are calculated and displayed in the diagram for the ventilated cigarette and the same cigarette with the ventilation holes completely blocked. Below numerical values for the open and closed draw resistance, the degree of filter and rod ventilation and the total degree of ventilation will be displayed.

If you have entered ISO smoke yield data for the reference cigarette, the ISO smoke yields will also be estimated and displayed.



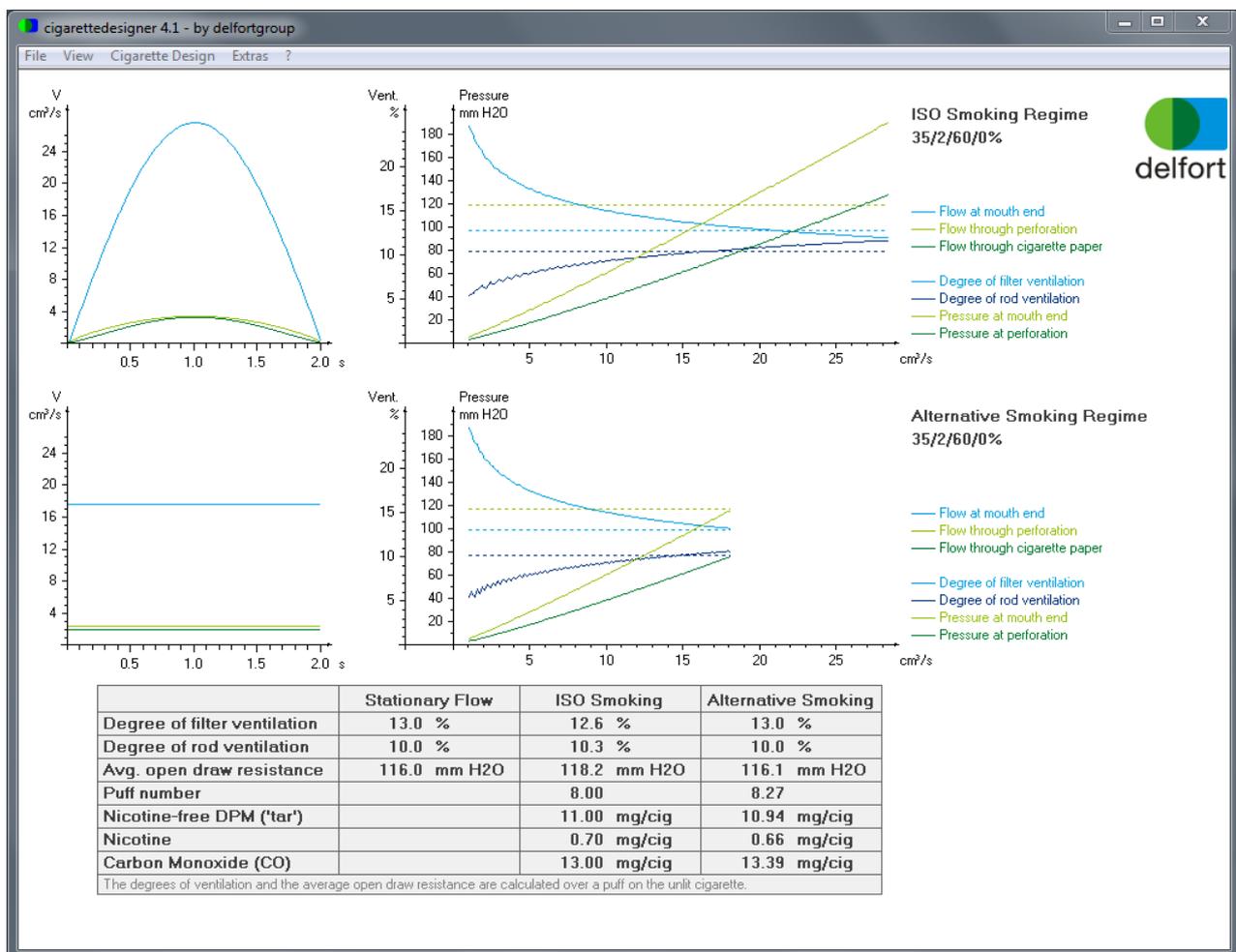
ISO and Alternative Yields

Displays a detailed flow analysis for an ISO puff and an alternative puff on the unlit cigarette. The top left graphs shows the flow rate during an ISO puff at the mouth end, through the perforation on the tipping paper and through the cigarette paper. The right diagram shows the degree of filter ventilation, the degree of rod ventilation, the pressure at the mouth end and the pressure at the perforation on the tipping paper as a function of the flow rate on the mouth end.

The same graphs are produced for a puff of the alternative smoking regime.

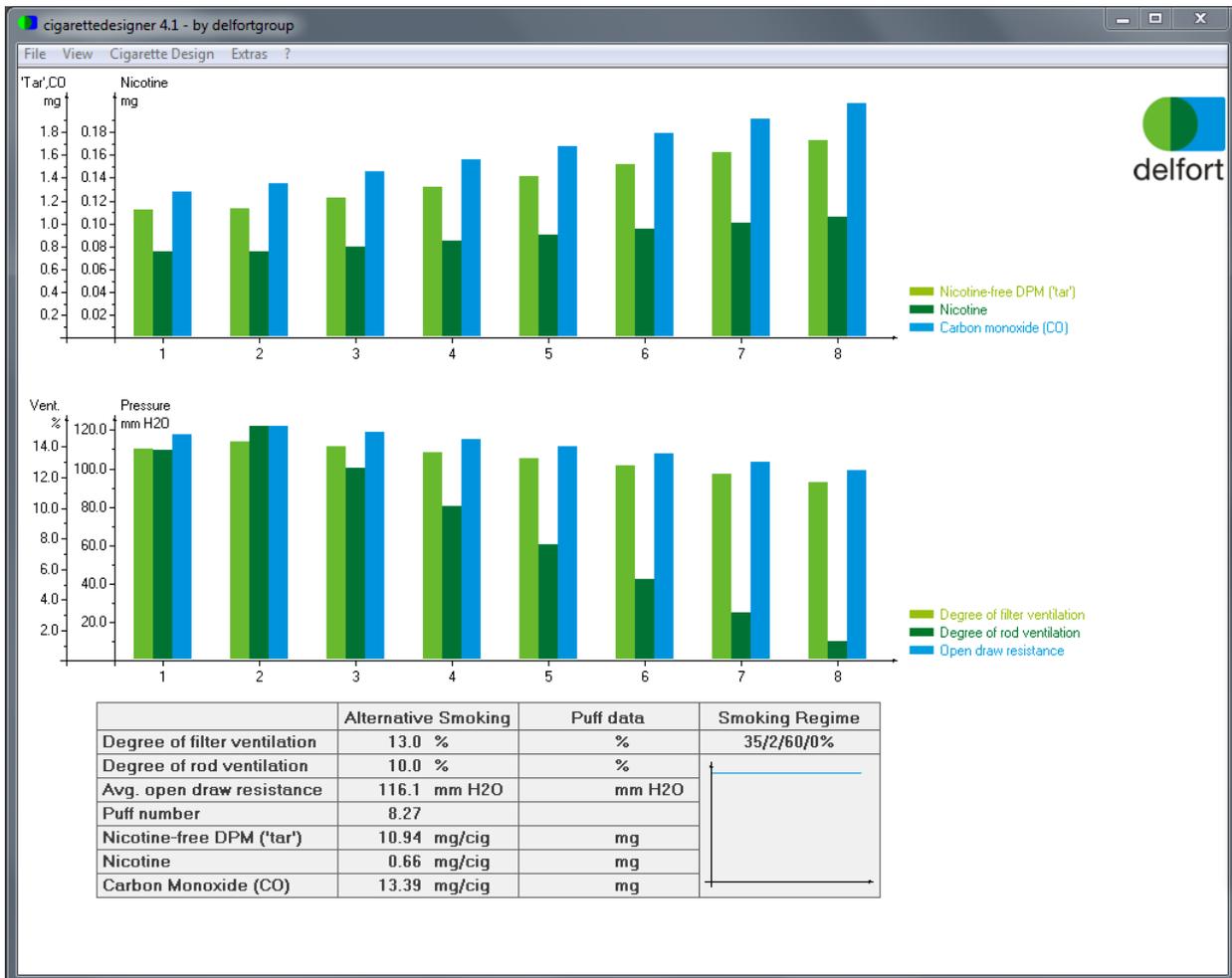
The table shows the puff filter ventilation, which is the ratio of the volume drawn through the tipping paper perforation to the total puff volume drawn at the mouth end during an ISO or alternative puff on the unlit cigarette. Likewise the puff rod ventilation is the ratio of the volume drawn through the cigarette paper to the total puff volume drawn at the mouth end. Furthermore the open draw resistance is averaged over a puff and displayed.

In case you have entered ISO smoke yield data for your reference cigarette, predictions of ISO and alternative smoke yields will be made.



Puff-by-Puff Analysis Results

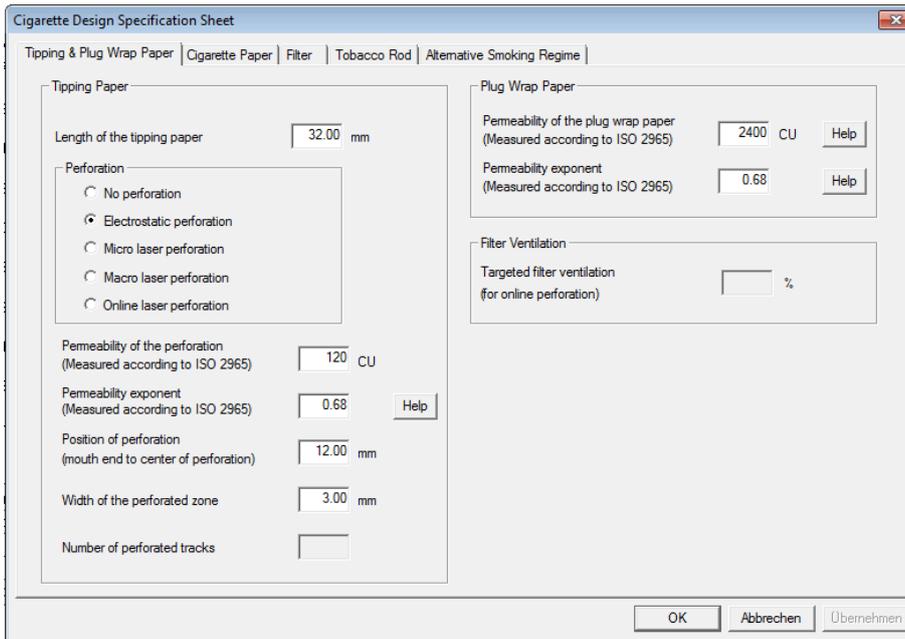
Displays a detailed puff-by-puff analysis for the alternative smoke regime. Upon selecting this display the simulation will start to recalculate the values whenever changes in the cigarette design have occurred. Depending on the chosen alternative smoking regime and the speed of your computer these simulations make take a few seconds. You will see a display as each puff is evaluated. In the top diagram nicotine-free dry particulate matter ('tar'), carbon monoxide (CO) and nicotine values will be displayed for each puff. The diagram below displays the degree of filter ventilation, the degree of rod ventilation and the average open draw resistance for each puff. To display numerical values for a specific puff in the table at the bottom, simply move the mouse pointer into the diagram area over the bars representing the puff in which you are interested.



Menu: Cigarette Design

The menus **Reference Cigarette** and **Current Cigarette** can be used to enter data of the reference cigarette and your current cigarette design, respectively. The dialog for entering the data is identical in both cases with a few exceptions which will be mentioned for each of the data specification sheets below.

Tiping and Plug Wrap Specification Sheet



Cigarette Design Specification Sheet

Tipping & Plug Wrap Paper | Cigarette Paper | Filter | Tobacco Rod | Alternative Smoking Regime

Tipping Paper

Length of the tipping paper: 32.00 mm

Perforation:

- No perforation
- Electrostatic perforation
- Micro laser perforation
- Macro laser perforation
- Online laser perforation

Permeability of the perforation (Measured according to ISO 2965): 120 CU

Permeability exponent (Measured according to ISO 2965): 0.68 Help

Position of perforation (mouth end to center of perforation): 12.00 mm

Width of the perforated zone: 3.00 mm

Number of perforated tracks:

Plug Wrap Paper

Permeability of the plug wrap paper (Measured according to ISO 2965): 2400 CU Help

Permeability exponent (Measured according to ISO 2965): 0.68 Help

Filter Ventilation

Targeted filter ventilation (for online perforation): %

OK Abbrechen Übernehmen

Allows you to specify the tipping paper, e.g. type of perforation, air permeability, position and width of the perforation etc. Also the plug wrap paper data can be entered here, e.g. its air permeability. The exponent for the air permeability is the exponent n in the pressure-drop flow relation

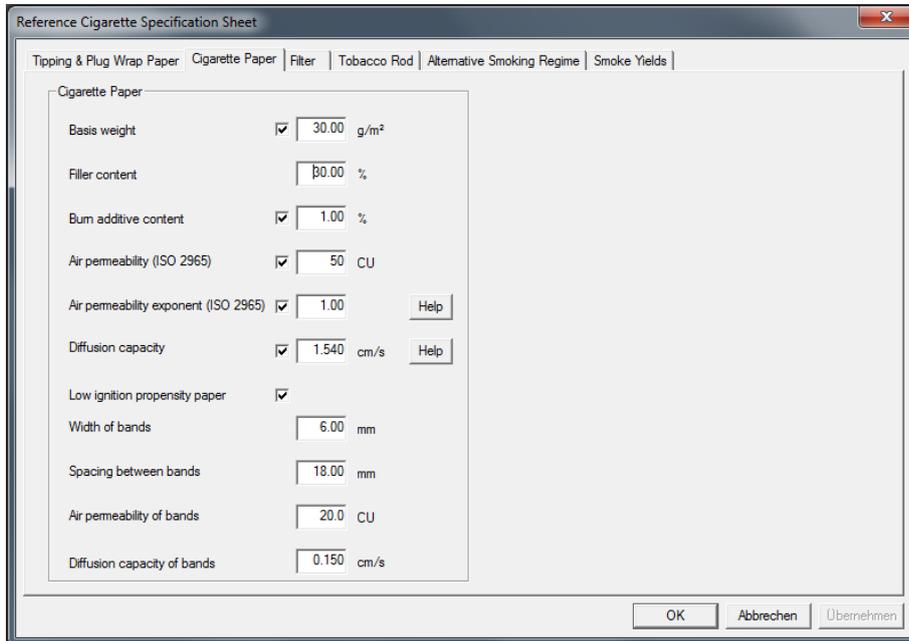
$V = k \cdot A \cdot p^n$, where V is the volumetric flow rate, A the air permeable area and p the pressure

difference. This exponent can be measured according to ISO 2965 by permeability measurement instruments from various manufacturers, its value is typically between 0.5 and 1.0. If the value is not available you may click on "Help" and the software will provide a reasonable value.

In case the plug wrap permeability is unknown clicking on "Help" will also provide a reasonable value based on the current tipping paper data.

Reference Cigarette only: The check boxes at the left of each text field will allow you to specify a value as unknown if you remove the check mark. For unknown data typical values will be used. You will not be able to modify parameters in your current cigarette design, if you mark them as unknown.

Cigarette Paper Specification Sheet



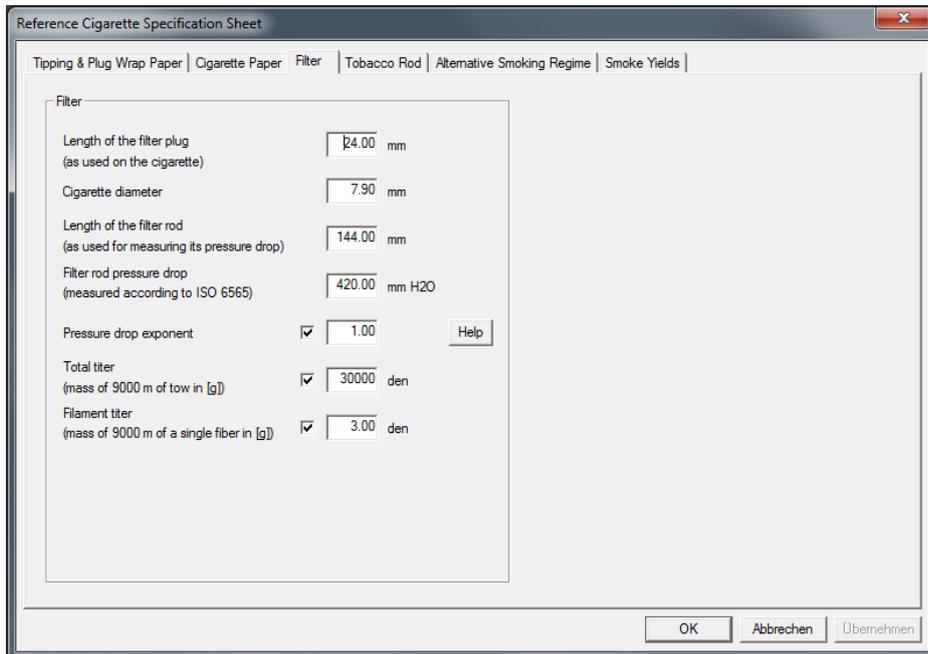
Parameter	Value	Unit
Basis weight	30.00	g/m ²
Filler content	30.00	%
Burn additive content	1.00	%
Air permeability (ISO 2965)	50	CU
Air permeability exponent (ISO 2965)	1.00	
Diffusion capacity	1.540	cm/s
Low ignition propensity paper	Checked	
Width of bands	6.00	mm
Spacing between bands	18.00	mm
Air permeability of bands	20.0	CU
Diffusion capacity of bands	0.150	cm/s

Allows you to enter data of the cigarette paper, such as basis weight, filler content and burn additive content. Furthermore you can enter the air permeability and the permeability exponent. The permeability exponent is derived from the same pressure drop-flow relation as for the tipping paper (see: Tipping and Plug Wrap Specification Sheet). Clicking on "Help" will set the value to 1.0, which is the typical value for this exponent. In general the exponent will not deviate significantly from 1.0. The diffusion capacity is the flow resistance with respect to concentration differences. It can be measured according to CORESTA Recommended Method No. 77 (to be published). If the value is unknown you may click on "Help" to provide a reasonable estimate based on the current cigarette paper data.

For cigarette papers with bands to comply with low ignition propensity regulations, the parameters such as band permeability, band diffusion capacity and band width and spacing can be set.

Reference Cigarette only: The check boxes at the left of each text field will allow you to specify a value as unknown if you remove the check mark. For unknown data typical values will be used. You will not be able to modify parameters in your current cigarette design, if you mark them as unknown.

Filter Specification Sheet



Parameter	Value	Unit	Unknown
Length of the filter plug (as used on the cigarette)	24.00	mm	<input checked="" type="checkbox"/>
Cigarette diameter	7.90	mm	<input checked="" type="checkbox"/>
Length of the filter rod (as used for measuring its pressure drop)	144.00	mm	<input checked="" type="checkbox"/>
Filter rod pressure drop (measured according to ISO 6565)	420.00	mm H2O	<input checked="" type="checkbox"/>
Pressure drop exponent	1.00		<input checked="" type="checkbox"/>
Total titer (mass of 9000 m of tow in [g])	30000	den	<input checked="" type="checkbox"/>
Filament titer (mass of 9000 m of a single fiber in [g])	3.00	den	<input checked="" type="checkbox"/>

Allows you to enter the filter data, e.g. the length of the filter plug on the cigarette, its diameter, its pressure drop and the filter tow specifications.

The pressure drop exponent is the exponent n in the flow-pressure drop relation

$\Delta p = k \cdot V^n / A$, where Δp is the pressure difference, k the draw resistance, V the volumetric flow and A the cross sectional area. Clicking on "Help" will set the value to 1.0 as in practice for mono-acetate filters the value will not deviate significantly from 1.0.

Two length values have to be specified: The length of the filter plug on the cigarette and the length of the filter rod used for measuring its pressure drop. This has the advantage of being able to modify the filter plug length on the cigarette without having to adjust the pressure drop of this filter plug according to the new length. This will be done automatically based on the filter rod length and the pressure drop of the filter rod.

Reference Cigarette only: The check boxes at the left of each text field will allow you to specify a value as unknown if you remove the check mark. For unknown data typical values will be used. You will not be able to modify parameters in your current cigarette design, if you mark them as unknown.

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Tobacco Rod Specification Sheet

Reference Cigarette Specification Sheet

Tipping & Plug Wrap Paper | Cigarette Paper | Filter | **Tobacco Rod** | Alternative Smoking Regime | Smoke Yields

Tobacco Rod

Length of the tobacco rod (as used on the cigarette)	<input type="text" value="60.00"/>	mm
Length of the tobacco rod (as used for measuring its pressure drop)	<input type="text" value="60.00"/>	mm
Tobacco rod pressure drop (according to ISO 6565)	<input type="text" value="60.00"/>	mm H2O <input type="button" value="Help"/>
Pressure drop exponent	<input checked="" type="checkbox"/> <input type="text" value="1.20"/>	<input type="button" value="Help"/>
Mass of tobacco in the rod (as used for measuring its pressure drop)	<input checked="" type="checkbox"/> <input type="text" value="750.00"/>	mg

Allows you to enter data for the tobacco rod, such as the length, the pressure drop and the tobacco mass. The pressure drop exponent is derived from the same flow-pressure drop relation as for the filter. The exponent is typically between 1.0 and 2.0. Clicking on "Help" will provide a reasonable value based on the current tobacco rod data.

The pressure drop of the tobacco rod is in many cases not known, but it can be estimated by clicking on "Help". A dialog box will appear, which allows you to enter certain cigarette parameters (open draw resistance, degree of filter ventilation, ...). These parameters will be used for an estimate of the tobacco rod pressure drop.

Reference Cigarette only: The check boxes at the left of each text field will allow you to specify a value as unknown if you remove the check mark. For unknown data typical values will be used. You will not be able to modify parameters in your current cigarette design, if you mark them as unknown.



Alternative Smoking Regime Specification Sheet

Reference Cigarette Specification Sheet

Tipping & Plug Wrap Paper | Cigarette Paper | Filter | Tobacco Rod | **Alternative Smoking Regime** | Smoke Yields

Smoking Regime

- 35 cm³ / 2 s / 60 s / 0% vent blocking (ISO)
- 35 cm³ / 2 s / 30 s / 0% vent blocking
- 55 cm³ / 2 s / 30 s / 50% vent blocking
- 60 cm³ / 2 s / 30 s / 50% vent blocking
- 45 cm³ / 2 s / 30 s / 100% vent blocking
- 55 cm³ / 2 s / 30 s / 100% vent blocking
- other

Puff volume: cm³

Puff duration: s

Puff interval (start of puff to start of next puff): s

Ventilation blocking: %

Puff shape

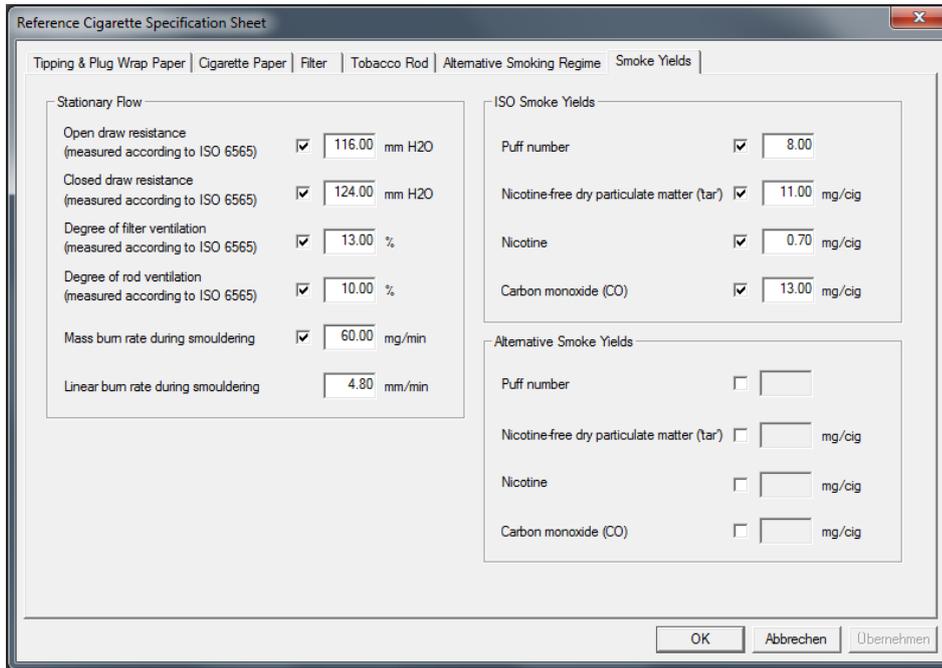
- Sinus (ISO)
- Rectangle
- Triangle
- Ramp

Allows you to specify the alternative smoking regime. You may enter the puff volume, the puff duration, the puff interval and the percentage of vent blocking. You can select from a pre-defined set of smoking regimes or enter numerical values directly. Additionally you can select the puff shape, e.g. sinus-shaped as in the ISO profile.

Furthermore you can click on "Load from file" to load an arbitrary puff shape. The file has to be a text file with one numerical value per line which specifies the flow rate. It is assumed that the values are at equidistant points in time. There need to be at least 2 and not more than 400 values in the file. The values will be scaled such that the puff volume matches the specified value, so the absolute values are not important, only the shape of the specified curve is preserved. Both "1.2345" and "1,2345" are valid numerical values. Such shape files can, e.g. be generated by exporting a table as a text file in MS Excel[®].

Reference Cigarette only: There is no need to specify the alternative smoking regime, if no smoke yield data for this smoking regime are available. If they are available, the smoke yield data for the alternative smoking regime can be entered in the Smoke Yields Specification Sheet.

Smoke Yields Specification Sheet



Stationary Flow	ISO Smoke Yields	Alternative Smoke Yields
Open draw resistance (measured according to ISO 6565) <input checked="" type="checkbox"/> 116.00 mm H2O	Puff number <input checked="" type="checkbox"/> 8.00	Puff number <input type="checkbox"/>
Closed draw resistance (measured according to ISO 6565) <input checked="" type="checkbox"/> 124.00 mm H2O	Nicotine-free dry particulate matter (tar) <input checked="" type="checkbox"/> 11.00 mg/cig	Nicotine-free dry particulate matter (tar) <input type="checkbox"/> mg/cig
Degree of filter ventilation (measured according to ISO 6565) <input checked="" type="checkbox"/> 13.00 %	Nicotine <input checked="" type="checkbox"/> 0.70 mg/cig	Nicotine <input type="checkbox"/> mg/cig
Degree of rod ventilation (measured according to ISO 6565) <input checked="" type="checkbox"/> 10.00 %	Carbon monoxide (CO) <input checked="" type="checkbox"/> 13.00 mg/cig	Carbon monoxide (CO) <input type="checkbox"/> mg/cig
Mass burn rate during smouldering <input checked="" type="checkbox"/> 60.00 mg/min		
Linear burn rate during smouldering 4.80 mm/min		

Reference Cigarette only: This page appears only for the reference cigarette and allows you to specify the smoke yields and other important cigarette parameters. These values are used to adapt the mathematical models to your specific cigarette design and to account for the tobacco blend and other parameters which are not included in the mathematical model. You may enter the degree of filter and rod ventilation, the open and closed draw resistance, the mass burn rate or the linear burn rate. Additionally, you may enter ISO smoke yields and the smoke yield data for the alternative smoking regime specified in the Alternative Smoking Regime Specification Sheet.

Note: Marking values in this dialog box as "unknown" will deteriorate the precision of the simulation results. You will always get predictions for degrees of ventilation and draw resistances but only for those smoke yields for which you have specified an ISO yield. It is not necessary to provide smoke yields for the alternative smoking regime to get predicted values, but doing so will improve the predictive quality especially if the alternative smoking regimes for the reference cigarette and the current cigarette design are identical.

If you do not enter at least the ISO puff number no puff-by-puff analysis can be performed.

Note: Choosing a target ventilation for online perforation will override the degree of filter ventilation in this specification sheet.

Copy to current

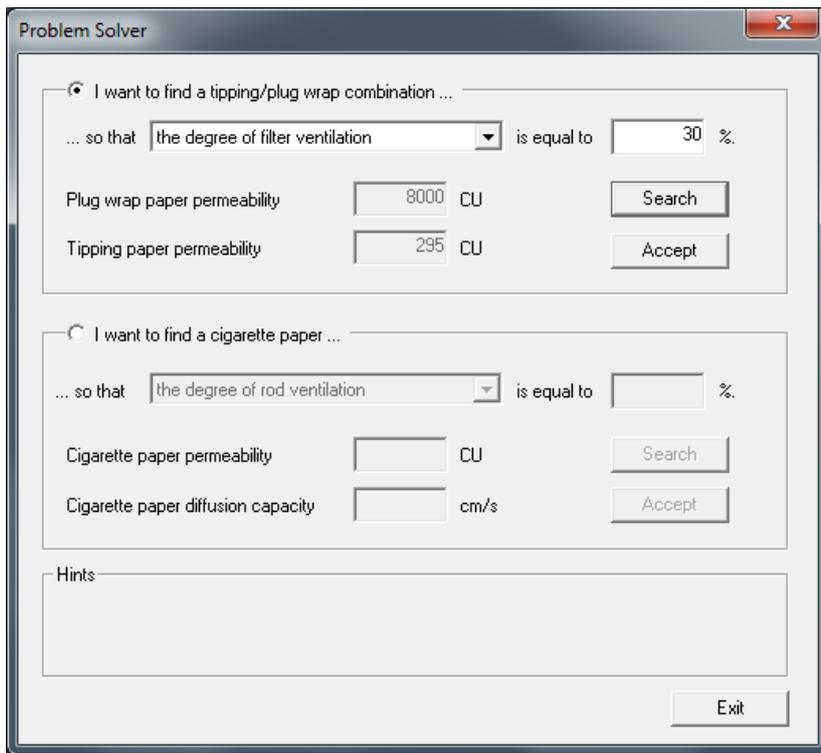
After specifying all the data for the reference cigarette you can copy the reference cigarette data to the current cigarette design. The reference cigarette and the current cigarette will then be identical and you can then start to modify the current cigarette design.

Menu: Extras

Puff by Puff Analysis

Calculates the puff-by-puff smoke yields and flow properties of the current cigarette design for the alternative smoking regime. Depending on the smoking regime and the speed of your computer these calculations may take a few seconds. You will see a display during evaluation of the puffs. The puff-by-puff analysis will be performed automatically whenever needed if you display the puff-by-puff analysis (View/Puff-by-Puff Analysis).

Problem Solver



Problem Solver

I want to find a tipping/plug wrap combination ...

... so that is equal to

Plug wrap paper permeability CU

Tipping paper permeability CU

I want to find a cigarette paper ...

... so that is equal to %

Cigarette paper permeability CU

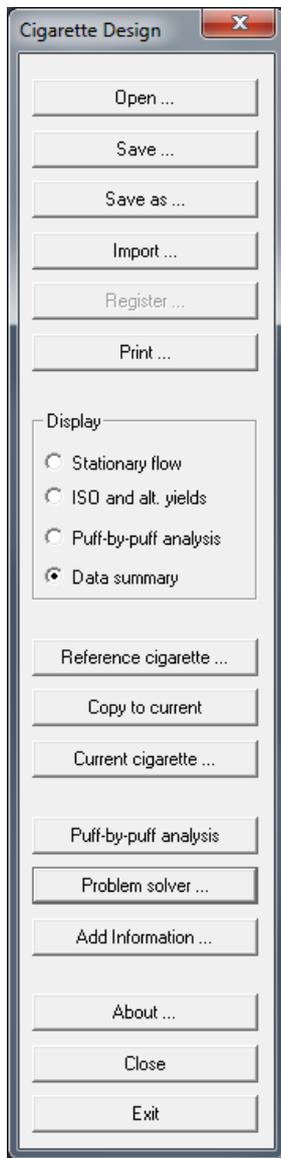
Cigarette paper diffusion capacity cm/s

Hints

The problem solver allows to either find a tipping/plug wrap combination or a cigarette paper to achieve certain design goals on your current cigarette design. First select whether you want to design a tipping/plug wrap combination or a cigarette paper, then select your design goal from the list of available options. Note that smoke yields cannot serve as a design goal, if they are marked as unknown in the reference cigarette specification sheet. Then enter the target value in the text field and start the search algorithm by clicking on "Search". The program will then propose a certain type of perforation/paper which you can accept as the current design by clicking on "Accept". On the bottom of the dialog box you will see hints with respect to the calculated results. You will, e.g. be informed whether the calculated permeability is too high/low for the chosen perforation type.

Note: If you choose online perforation, the problem solver will not be available.

Menu Bar



By selecting this option a menu bar will appear which offers the same functionality as the menu itself, but it can be accessed more quickly than through the menu.

Clicking on "Close" will close the menu bar window, while clicking on "Exit" will terminate the program.

Add Information

Allows to enter a few lines of text, e.g. to describe the cigarette or to note the design goal. This information will be saved and printed along with the cigarette design.

Using the program

The first step in designing a cigarette is to enter the data of the existing cigarette design in the reference cigarette specification sheet (Menu: Cigarette Design/Reference Cigarette). This set of data is used to adapt the mathematical models to improve the predictive quality. Then copy the reference cigarette to the current cigarette design (Menu: Cigarette Design/Copy to current). You are then ready to start the design process either by manually modifying the current design (Menu: Cigarette Design/Current Cigarette) or by solving design problems automatically (Menu: Extras/Problem Solver). You can also produce a detailed analysis by selecting the puff-by-puff analysis (Menu: Extras/Puff by Puff Analysis).