

Operation of WinVent 4.0

by Christoph Cesana and Richard Siwek

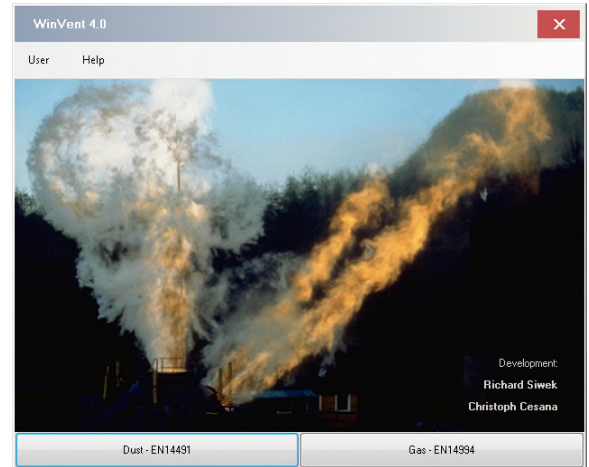
Introduction



The following will help to understand the use of WinVent 4.0.

After starting WinVent 4.0 a decision must be made regarding the fuel involved in the design of a proper explosion venting system.

When pushing one of the two fuel buttons the main window will appear. In the following example it will be Dust.

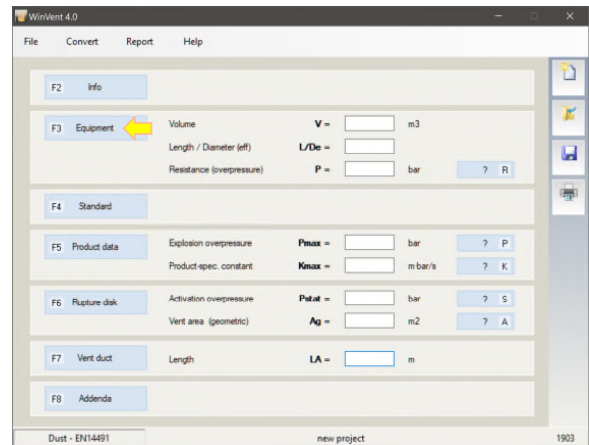


Main window

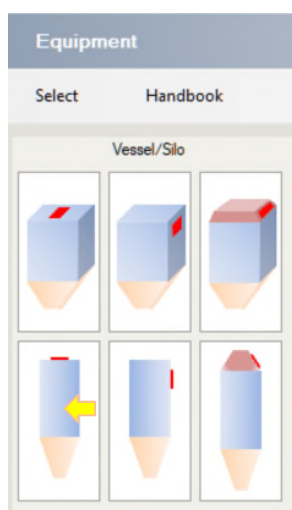
Main window of WinVent:

This window summarizes 7 additional windows: Each one must be treated separately.

After that the most important parameters will appear on the main window.



F3 Vessel

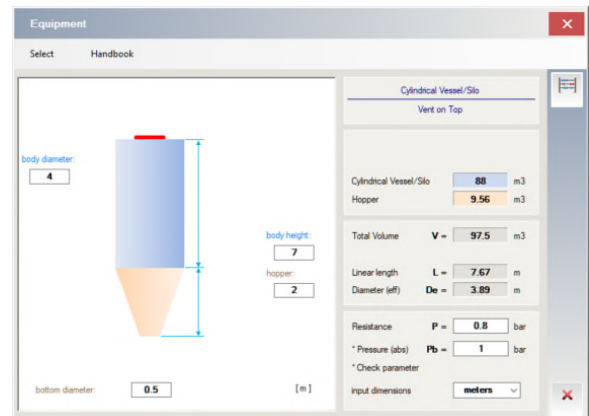


Silos: The position of the Vent Device on the Silos must be considering during the selection of a silo.

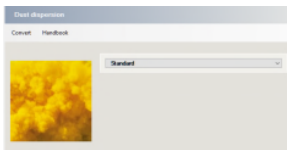
Filters: The position of the Vent Device with respect to the filter elements is very important and must be taken into account during the selection of a filter.

Cyclone: The only position of the Vent Device is on the top of the air outlet pipe. Therefore only the necessary pressure resistance has to be calculated.

Building: For a proper design please consider the Handbook (Chapter 6.5) and EN 14491.



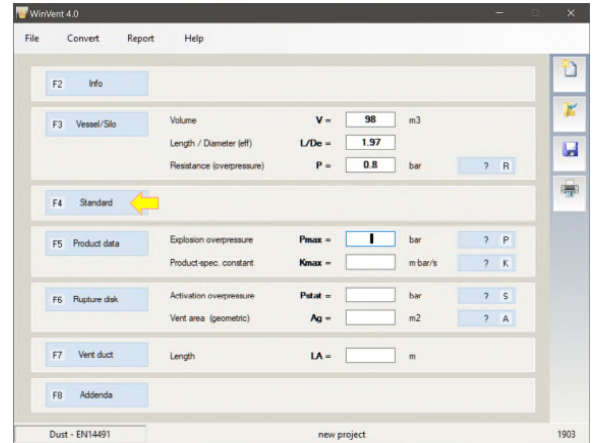
F4 Standard



Dust Dispersion: Choose the type of dust dispersion and give the additional information.

Default value is “Standard” (ISO/VDI) dispersion). This dispersion system is the most conservative.

Note: In case of doubt use the standard dispersion.



F5 Product data

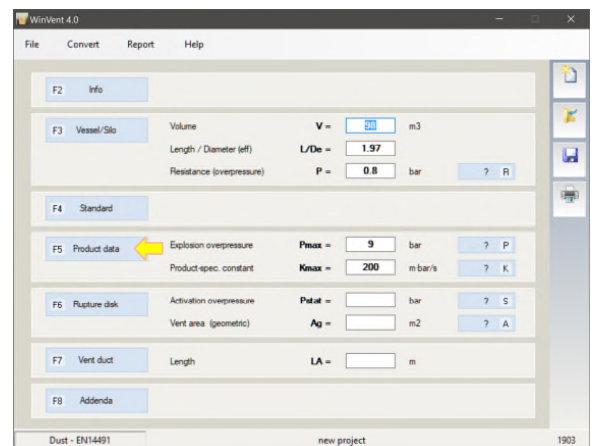


Product Data: Consider the wide scatter and large standard deviation of the laboratory data. To deal with this increase the laboratory data at least by 10%.

Example:

$P_{max} = 8.1$ bar insert **9** bar and
 $K_{max} = 176$ m*bar/s insert **200** m*bar/s.

Indicate also if the dust is a metal dust or the dust contains solvent.

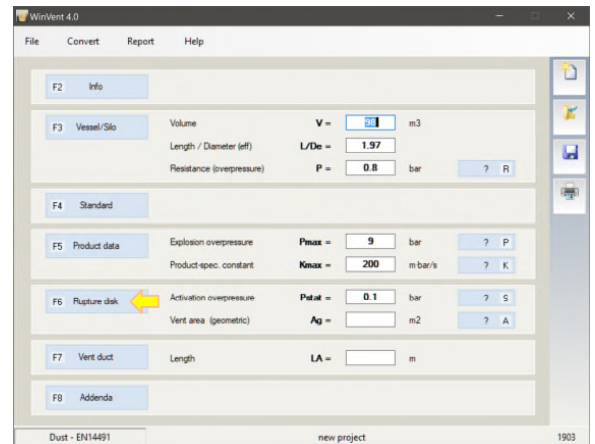


F6 Disk / Vent

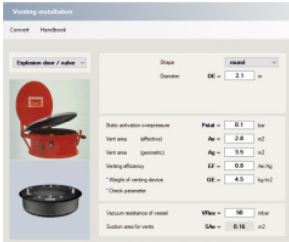


Rupture Disk: For calculation of the vent area insert only the shape, the static activation overpressure P_{stat} , the vent efficiency EF and the specific weight GE of vent device.

Flameless Vent: If a flameless venting device is used please use the rupture disk window.

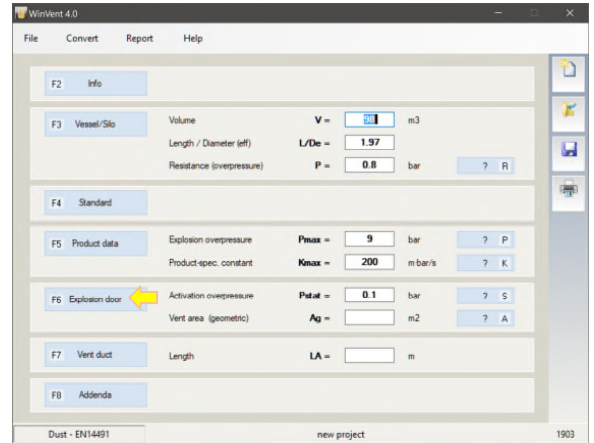


F6 Door / Valve



Explosion Door: For calculation of the vent area insert only the shape, the static activation overpressure P_{stat} , the vent efficiency EF and the specific weight GE of vent device. If the system is reclosing then insert the vacuum resistance of the vessel $VRes$ for calculation the size of vacuum breakers.

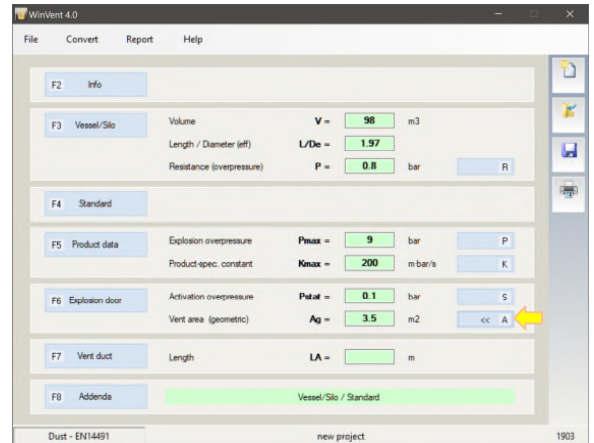
Flameless Valve: If an explosion relief valve system is used please use the explosion door window. Because this flameless valve is a re-closing system, installation of vacuum breakers must be considered. If so insert the vacuum resistance of the vessel $VRes$.



R, P, K, S, A Calculation

Calculation of ...

- A = vent area
- ... and without vent duct ...
- R = resistance
- P = explosion overpressure
- K = product. spec. constant
- S = activation overpressure
- ... as a function of other variables



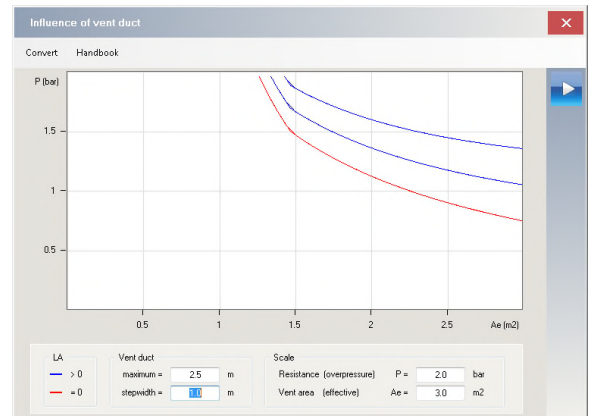
F7 Vent duct



Position of vent duct: Choose the position of the vent duct: longitudinal or transversal.

Note: Default value is transversal: This settings represents the worst case.

Influence of vent duct: With this tool Winvent 4.0 shows the influence of the effective vent area A_e on the maximum reduced explosion overpressure $P_{red,max}$ for the given situation.



Influence of Vent duct

Example:

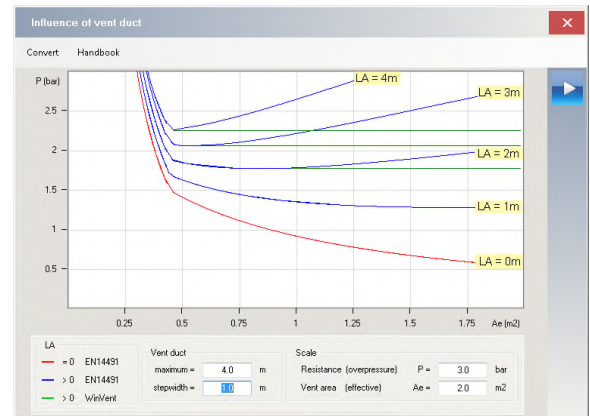
$$V = 20 \text{ m}^3$$

$$L/De = 6$$

$$P_{\max} = 9 \text{ bar}$$

$$K_{\max} = 200 \text{ m} \cdot \text{bar/s}$$

$$P_{\text{stat}} = 0.1 \text{ bar}$$



Problem

With increasing vent area first the pressure decreases in order to rise again continuously after reaching a minimum! The standard EN 14491 calculates the maximum reduced explosion overpressure with vent duct with formula (17):

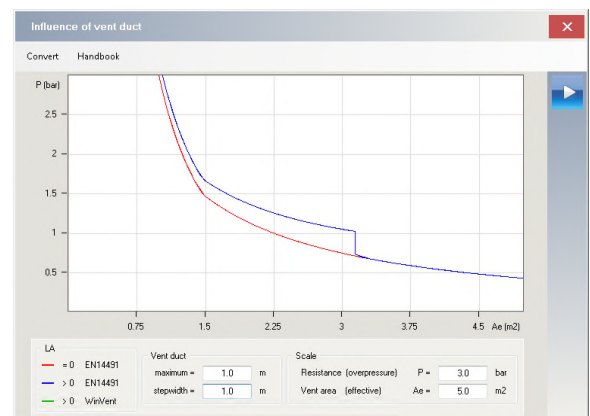
$$P = P_0 \cdot \left(1 + 17.3 \cdot LA \cdot (Ag \cdot V^{-0.753})^{1.6} \right)$$

The formula gives this strange behavior.

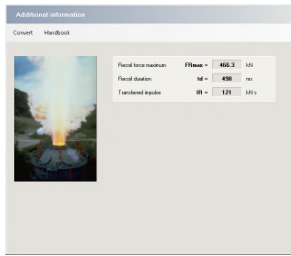
WinVent 4.0 takes the minimum pressure and keeps this value constant with increasing vent area (green line).

No Influence of Vent duct

The presence of the vent duct has no influence if the ratio of length to diameter $LA/DE \leq 0.5$



F8 Addenda



Recoil forces:

WinVent calculates always:

The recoil force maximum FF_{max}

The recoil duration t_d

The transferred impulse IR

Flame length external to a vent:

If the conditions for these calculations are fulfilled WinVent calculates:

The flame range horizontally LF_h

The flame range vertical LF_v

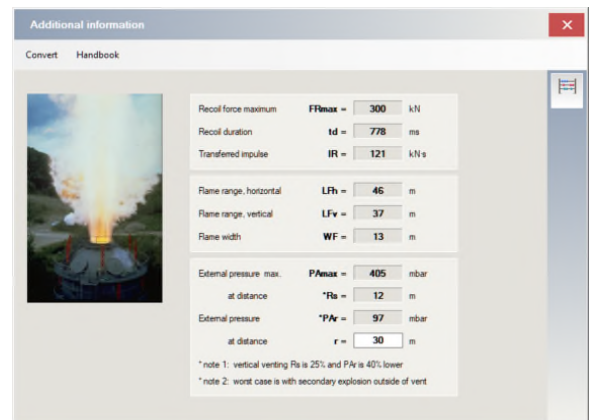
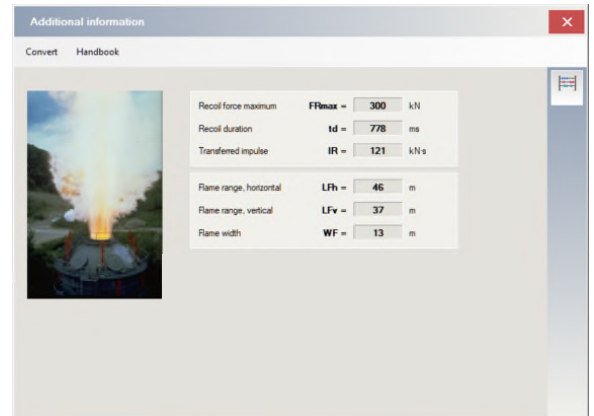
The flame width WF

Pressure effects external to a vent:

If the conditions for these calculations are fulfilled WinVent calculates:

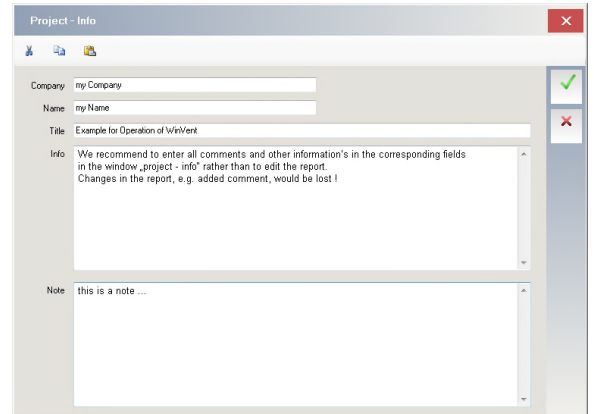
The external pressure max. P_{Amax} at a distance of R_s and the external pressure P_{Ar} at any distance $r > R_s$.

Note: WinVent calculates always the worst case, that is horizontal venting and outside vent with secondary explosion.

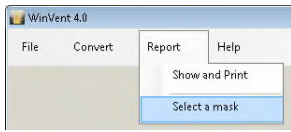


F2 Info

We recommend to enter all comments and other information's in the corresponding fields in the window „project - info“ rather than to edit the report. Changes in the report, e.g. added comment, would be lost !

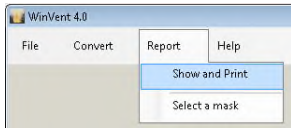


Print the Report



1. Select a mask

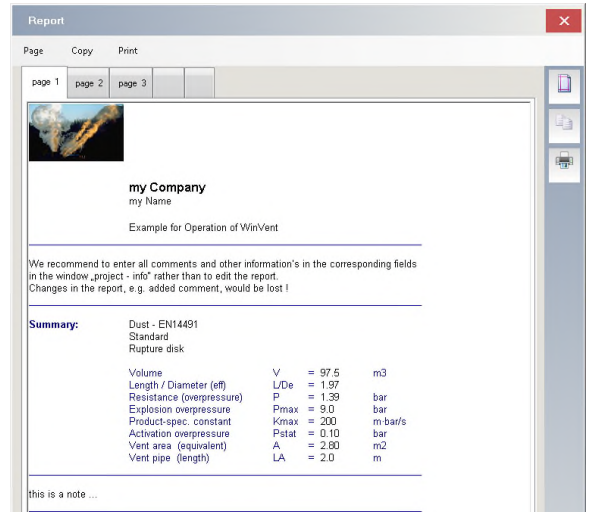
The WinVent-software contains some sample masks for the report in different languages.



2. Print the report

The results of your calculations are then inserted automatically by the program in the mask and a report is produced. This can be edited as a whole and then printed out.

or ...



Editing masks

Aim and object of the mask is to enter repetitive text and to define all those fields in which variables should be entered automatically for the report.

The WinVent-software contains some sample masks in different languages. These masks can be easily adapted to your requirements.

Any Editor-program supporting the Rich-Text-Format (.rtf) is suitable (e.g. "Write", "WordPad" and "Word").

These masks are split into several sections. Each section starts with a "@"-code. Please do never modify this codes. All fields for variables are marked by "#"-code.

Advanced formatting features (e.g. tables, frames, background colors) are not supported. The functionality corresponds to "Write" or "WordPad".

