

5.5.2 UseCAD Air Valves

The following functions are controlled by automatic air valves:

- Release of the air in the pipeline while it is being filled
- Venting the pipeline while it is being emptied or in case of a pipe break.
- Air release during operation to eliminate residual amounts of gas at operating pressure

An adequate automatic air valve is selected using UseCAD Air Valves in the following way:

In a first step you have to enter the medium used. Based on your selection, the programme will retrieve valves for drinking water or waste water applications for your calculation.

VAG Air Valve Calculation 7.0

Input | Pipe profile | Logic Analysis | Result | Print pdf | Sales text | Project | Help | Selection

Dimensioning and positioning of air valves

Pipeline mat.: Steel
Pipe roughness: 0.150 (mm)
Pressure stage, PN: 6
Nominal Diameter, DN: 400
Wallthickness: 7.10 (mm)
Outside diameter: 406.4 (mm)

Filling process: filling with control valve
Filling volume: 0.036 (m³/s) 0.30 (m/s)
Joukowsky surge pressure: 3.51 (bar)
Operating volume flow: 0.242 (m³/s) 2.00 (m/s)
Drainage volume: 0.036 (m³/s) 0.30 (m/s)

Pipe break: Yes
Safety factor against collapsing: 2.00
Ratio pipeburst / pipe area [%]: 50
minimal distance between valves: 500 (m) ☒ Smooth the Profiles

Type of valve: DUQUET
Inlet pressure: 60.00 (mW/C)

System: Medium: Water, System: Gravitations System

Pipe run:

Point Nr.	Position x [m]	Elevation h [m]
0	0	0

Buttons: Add, Delete, Excel import, Excel export, Calculation, New, Open, Save, Print PDF, Exit

For the selection of the pipeline materials, the most commonly used materials are available.

VAG Air Valve Calculation 7.0

Input | Pipe profile | Logic Analysis | Result | Print pdf | Sales text | Project | Help | Selection

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System: Medium: Water, System: Gravitations System

Pipe run:

Point Nr.	Position x [m]	Elevation h [m]
0	0	0

Buttons: Add, Delete, Excel import, Excel export, Calculation, New, Open, Save, Print PDF, Exit

Depending on the pressure rating and nominal diameter selected, the pipeline dimensions will be added automatically. Should your pipeline specifications deviate from those suggested here, you can overwrite them.

VAG Air Valve Calculation 7.0

Input | Pipe profile | Logic Analysis | Result | Print pdf | Sales text | Project | Help | Selection

Dimensioning and positioning of air valves

Pipeline mat.: Steel

Pipe roughness: 0.150 (mm) ...

Pressure stage, PN: 6

Nominal Diameter, DN: 400

Wallthickness: 7.10

Outside diameter: 406.4

Filling process: filling with control valve

Filling volume: 0.036 (m³)

Joukowsky surge pressure: 3.51 (bar)

Operating volume flow: 0.242 (m³/s)

Drainage volume: 0.036 (m³/s)

Pipe break: Yes

Safety factor against collapsing: 2.00

Ratio pipeburst / pipe area [%]: 50

minimal distance between valves: 500 (m)

Type of valve: DUQUET

Inlet pressure: 60.00 (mW/C)

System: Medium: Water, System: Gravitations System

Pipe run:

Point Nr.:	Position x [m]	Elevation h [m]
0	0	

Buttons: Add, Delete, Excel import, Excel export, Calculation, New, Open, Save, Print PDF, Exit

Depending on the material and condition of the pipeline, you can enter various degrees of roughness of the pipe. To obtain suggestions, click on the button “...” to the right of the entry field.

To calculate the required valve size, the Programme requires indications on the volume flows in your system as specific as possible. In the process, the programme distinguishes between the filling, operation and clearing volume flow. For the filling process, the programme calculates the pressure surge to be expected when filling your pipeline at the velocity entered. The pressure surge should not exceed the standard value of 3 bars.

VAG Air Valve Calculation 7.0

Input | Pipe profile | Logic Analysis | Result | Print pdf | Sales text | Project | Help | Selection

Dimensioning and positioning of air valves

Pipeline mat.: Steel

Pipe roughness: 0.150 (mm) ...

Pressure stage, PN: 6

Nominal Diameter, DN: 400

Wallthickness: 7.10 (mm)

Outside diameter: 406.4 (mm)

Filling process: filling with control valve

Filling volume: 0.036 (m³/s) 0.30 (m/s)

Joukowsky surge pressure: 3.51 (bar)

Operating volume flow: 0.242 (m³/s) 2.00 (m/s)

Drainage volume: 0.036 (m³/s) 0.30 (m/s)

Pipe break: Yes

Safety factor against collapsing: 2.00

Ratio pipeburst / pipe area [%]: 50

minimal distance between valves: 500 (m) ☒ Smooth the Profiles

Type of valve: DUQUET

Inlet pressure: 60.00 (mW/C)

System: Medium: Water, System: Gravitations System

Pipe run:

Point Nr.:	Position x [m]	Elevation h [m]
0	0	

Buttons: Add, Delete, Excel import, Excel export, Calculation, New, Open, Save, Print PDF, Exit

Should you fill your pipeline with-out control, the programme will calculate an orifice diameter to limit the velocity of the escaping air in order to achieve the desired filling velocity. This orifice diameter is also used in VAG's "Anti-Surge Solution".

VAG Be- und Entlüftungsventile Auslegungsprogramm 7.0

Eingabe | Leitungsverlauf | Logik-Analyse | Ergebnis | Druck.pdf | Ausschreibungstexte | Projekt | Hilfe | Selektion

Auslegungsprogramm: Positionierung von Be- und Entlüftungsventilen

Leitungswerkstoff: Stahl
 Rohrauhigkeit: 0,000 (mm)
 Druckstufe, PN: 6
 Nennweite, DN: 400
 Wandstärke: 7,10 (mm)
 Außendurchmesser: 406,4 (mm)

System: Medium: Wasser, System: Gravitations System

Füllvorgang: Füllprozess ohne Regelventil
 Q Füllen: 0,024 (m³/s) 0,20 (m/s)
 Druckstoss nach Joukowski: 2,00 (bar)
 Q Betrieb: 0,242 (m³/s) 2,00 (m/s)
 Q Leeren: 0,036 (m³/s) 0,30 (m/s)

Auslegung Rohrbruch: Ja
 Sicherheitfaktor el. Verformung: 2,00
 Bruchquerschnitt [%]: 50

min. Abstand zwischen BEV: 500 (m) ☒ Glätten des Profils
 Ventil Bauart: DUQUET AS
 Vordruck (s): 60,00 (m/s)

Leitungsverlauf: Punkt Nr. | Position x [m] | Höhe h [m]
 0 | 0 |

Hinzufügen | Entfernen | Excel Import | Excel Export

Berechnung | Neu | Öffnen | Speichern | PDF erzeugen | Ende

Air valves used as protection devices against pipe breaks can be calculated as an option. For this calculation a safety factor against indentation of the pipeline must be entered. You can select the partial break size as a per cent value of the pipeline diameter. In case of no selection a standard value of 50 % will be insert.

VAG Be- und Entlüftungsventile Auslegungsprogramm 7.0

Eingabe | Leitungsverlauf | Logik-Analyse | Ergebnis | Druck.pdf | Ausschreibungstexte | Projekt | Hilfe | Selektion

Auslegungsprogramm: Positionierung von Be- und Entlüftungsventilen

Leitungswerkstoff: Stahl
 Rohrauhigkeit: 0,150 (mm)
 Druckstufe, PN: 6
 Nennweite, DN: 400
 Wandstärke: 7,10 (mm)
 Außendurchmesser: 406,4 (mm)

System: Medium: Wasser, System: Gravitations System

Füllvorgang: Füllprozess mit Regelventil
 Q Füllen: 0,036 (m³/s) 0,30 (m/s)
 Druckstoss nach Joukowski: 3,51 (bar)
 Q Betrieb: 0,242 (m³/s) 2,00 (m/s)
 Q Leeren: 0,036 (m³/s) 0,30 (m/s)

Auslegung Rohrbruch: Ja
 Sicherheitfaktor el. Verformung: 2,00
 Bruchquerschnitt [%]: 50

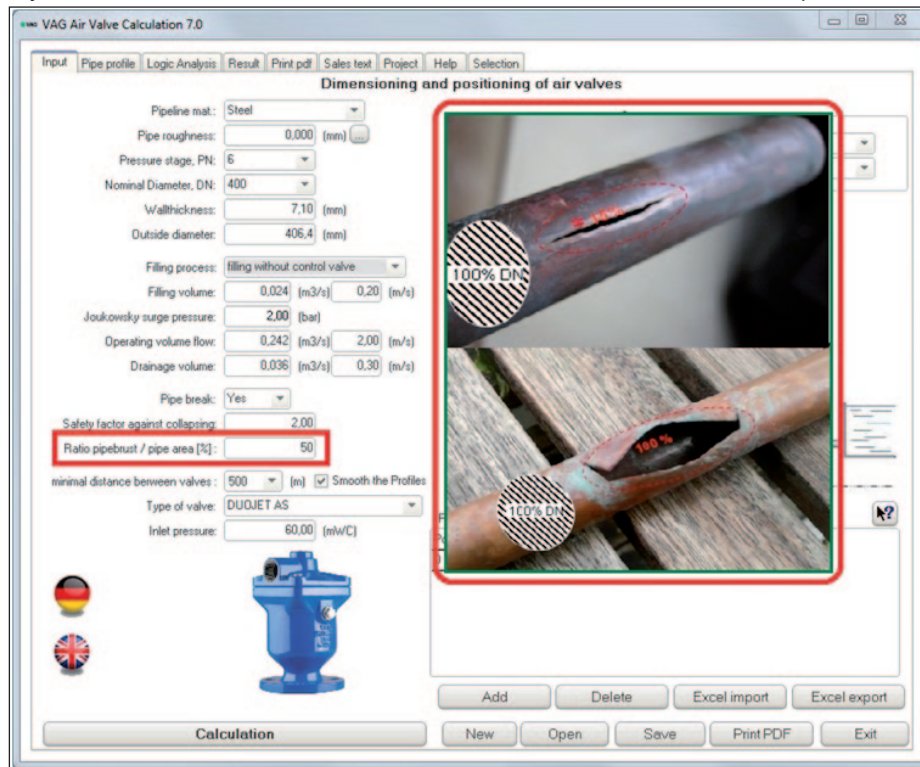
min. Abstand zwischen BEV: 500 (m) ☒ Glätten des Profils
 Ventil Bauart: DUQUET
 Vordruck (s): 60,00 (m/s)

Leitungsverlauf: Punkt Nr. | Position x [m] | Höhe h [m]
 0 | 0 |

Hinzufügen | Entfernen | Excel Import | Excel Export

Berechnung | Neu | Öffnen | Speichern | PDF erzeugen | Ende

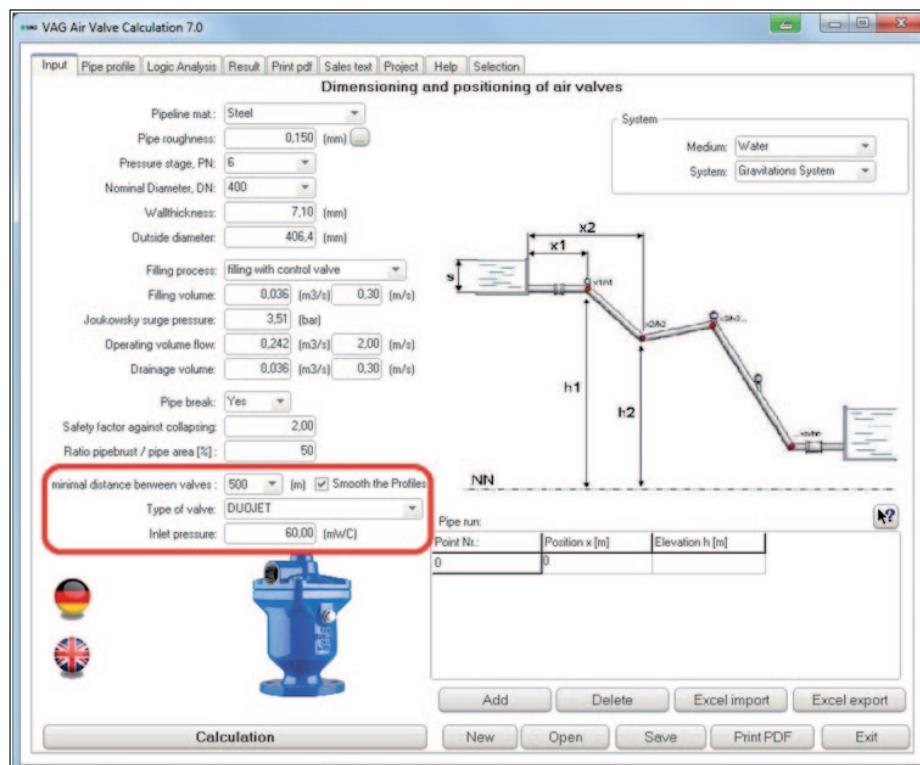
If you run the mouse cursor across the text “cross section of break”, examples of this will be shown.



Further available options are the selection of the distances between valves in long pipeline sections and the pre-selection of the valve type if water is used as a medium.

You can choose between:

- VAG DUOJET: Single-chamber valve
- VAG TWINJET: Double-chamber valve



You can enter an altitude profile either manually or by entering the coordinates or by importing the data needed from an Excel spreadsheet.

Here it is sufficient if the spreadsheet is open in the background and when you click on the “Excel Import” button.

Input | Pipe profile | Logic Analysis | Result | Print pdf | Sales text | Project | Help | Selection

Dimensioning and positioning of air valves

Pipeline mat: Steel
 Pipe roughness: 0.040 (mm)
 Pressure stage, PN: 6
 Nominal Diameter, DN: 400
 Wall thickness: 7.10 (mm)
 Outside diameter: 406.4 (mm)
 System: Medium: Water, System: Gravitations System
 Filling process: filling without control valve
 Filling volume: 0.024 (m³/s) 0.20 (m/s)
 Joukowski surge pressure: 2.00 (bar)
 Operating volume flow: 0.242 (m³/s) 2.00 (m/s)
 Drainage volume: 0.036 (m³/s) 0.30 (m/s)
 Pipe break: Yes
 Safety factor against collapsing: 2.00
 Ratio pipeburst / pipe area [%]: 50
 minimal distance between valves: 500 (m) ☒ Smooth the Profiles
 Type of valve: DUQUET AS
 Inlet pressure: 60.00 (mWC)
 Calculation
 New Open Save Print PDF Exit

Pipe run:

Point Nr.	Position x [m]	Elevation h [m]
0	0	500
1	6000	350
2	10000	400
3	14000	300
4	17000	420
5	20000	400

Add Delete Excel import Excel export

You can overwrite the default inlet pressure (tank pressure) to adapt it to the conditions of your equipment.

Input | Pipe profile | Logic Analysis | Result | Print pdf | Sales text | Project | Help | Selection

Dimensioning and positioning of air valves

Pipeline mat: Steel
 Pipe roughness: 0.150 (mm)
 Pressure stage, PN: 6
 Nominal Diameter, DN: 400
 Wall thickness: 7.10 (mm)
 Outside diameter: 406.4 (mm)
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 Joukowski surge pressure: 3.51 (bar)
 Operating volume flow: 0.242 (m³/s) 2.00 (m/s)
 Drainage volume: 0.036 (m³/s) 0.30 (m/s)
 Pipe break: Yes
 Safety factor against collapsing: 2.00
 Ratio pipeburst / pipe area [%]: 50
 minimal distance between valves: 500 (m) ☒ Smooth the Profiles
 Type of valve: DUQUET
 Inlet pressure: 60.00 (mWC)
 Calculation
 New Open Save Print PDF Exit

Pipe run:

Point Nr.	Position x [m]	Elevation h [m]
0	0	

Add Delete Excel import Excel export

When you select the option “Smooth profile”, minor fluctuations in the pipeline course are suppressed. All peaks which are not pronounced enough will no longer be considered in the computation.

VAG Air Valve Calculation 7.0

Input | Pipe profile | Logic Analysis | Result | Print pdf | Sales text | Project | Help | Selection

Dimensioning and positioning of air valves

Pipeline mat: Steel
 Pipe roughness: 0.040 (mm)
 Pressure stage, PN: 6
 Nominal Diameter, DN: 400
 Wallthickness: 7.10 (mm)
 Outside diameter: 406.4 (mm)

System: Medium: Water, System: Gravitations System

Filling process: filling without control valve
 Filling volume: 0.024 (m³/s) 0.20 (m/s)
 Joukowski surge pressure: 2.00 (bar)
 Operating volume flow: 0.242 (m³/s) 2.00 (m/s)
 Drainage volume: 0.036 (m³/s) 0.30 (m/s)

Pipe break: Yes
 Safety factor against collapsing: 2.00
 Ratio pipeburst / pipe area [%]: 50

minimal distance between valves: 500 [m] ☒ Smooth the Profiles
 Type of valve: DUQUET AS
 Inlet pressure: 60.00 (mWC)

Pipe run:

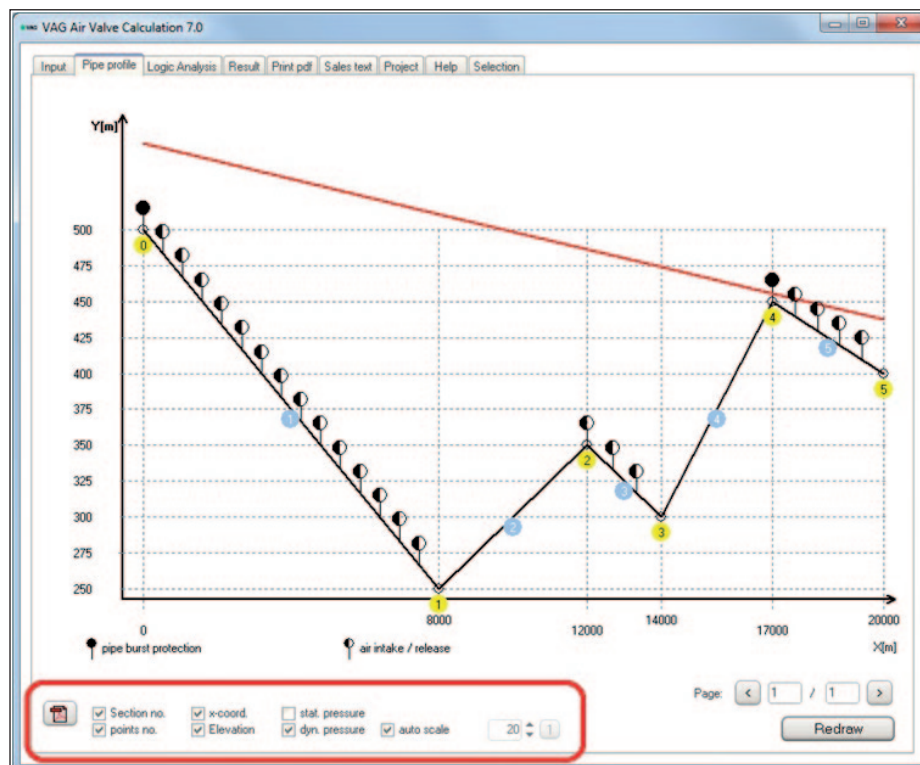
Point Nr.	Position x [m]	Elevation h [m]
0		

Buttons: Add, Delete, Excel import, Excel export, Calculation, New, Open, Save, Print PDF, Exit

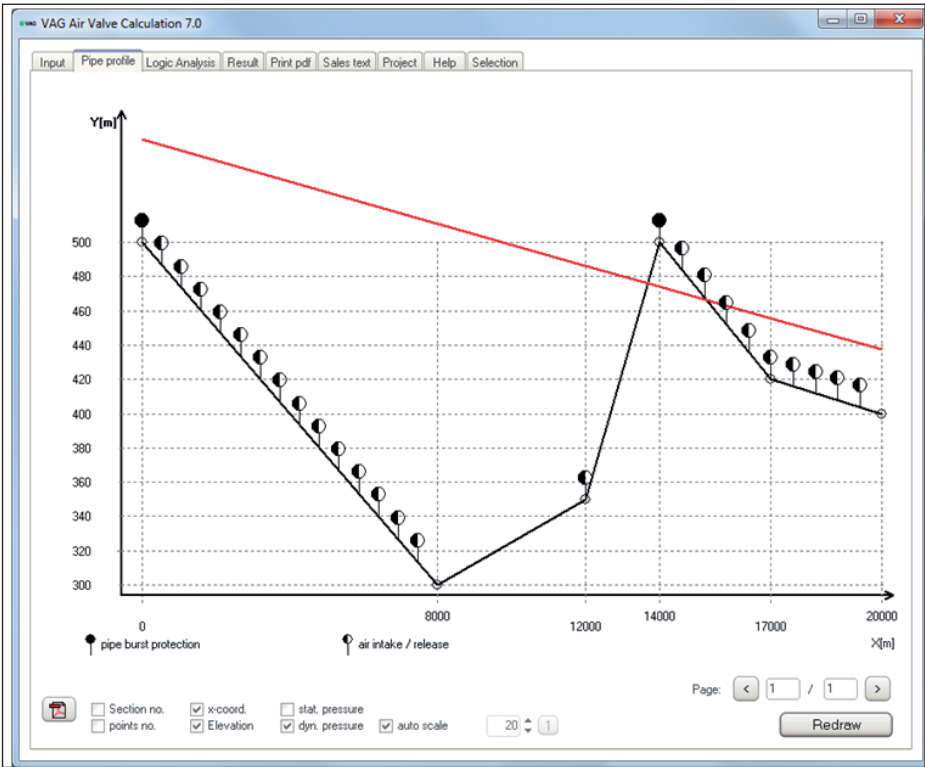
The results of the computation will be displayed graphically in the form of the elevation curve based on the data you entered and as a table listing the valves to be positioned.

The graphic representation offers the possibility of having the numbers of the individual pipeline sections and the co-ordinates displayed. It is also possible to display the dynamic pressure curve to identify critical peaks, if required, where a vacuum may build up.

The Auto-Scaling option enables you to determine the number of pages of the hardcopy. With this setting you determine the number of pipeline points to be displayed per page.



Critical highpoint means that the hydraulic gradient line is lower than the level of the pipeline or the Air valve. If this condition happens the pipeline has to be redesigned.



The displayed table shows the coordinates, number of air valves and the selected valve type.

Nr	Pos	X Coord	Y Coord	Dynamic Pressure	Installation Position	Function	Type of Valve	Size of Valve	Orifice Plate
1	P.0	0.0	500.0	60.0	OK	clearing/pipe burst protection	DUOJET	DN50	
2	S.1	545.5	486.4	70.3		air intake / release	DUOJET	DN50	
3	S.1	1090.9	472.7	80.6		air intake / release	DUOJET	DN50	
4	S.1	1636.4	459.1	90.9		air intake / release	DUOJET	DN50	
5	S.1	2181.8	445.5	101.2		air intake / release	DUOJET	DN50	
6	S.1	2727.3	431.8	111.5		air intake / release	DUOJET	DN50	
7	S.1	3272.7	418.2	121.7		air intake / release	DUOJET	DN50	
8	S.1	3818.2	404.5	132.0		air intake / release	DUOJET	DN50	
9	S.1	4363.6	390.9	142.3		air intake / release	DUOJET	DN50	
10	S.1	4909.1	377.3	152.6		air intake / release	DUOJET	DN50	
11	S.1	5454.5	363.6	162.9		air intake / release	DUOJET	DN50	
12	P.1	6000.0	350.0	173.2	OK	low point	-	-	
13	P.2	10000.0	400.0	98.7	OK	air intake / release	DUOJET	DN50	
14	S.3	10571.4	385.7	109.5		air intake / release	DUOJET	DN50	
15	S.3	11142.9	371.4	120.3		air intake / release	DUOJET	DN50	
16	S.3	11714.3	357.1	131.1		air intake / release	DUOJET	DN50	
17	S.3	12285.7	342.9	141.8		air intake / release	DUOJET	DN50	
18	S.3	12857.1	328.6	152.6		air intake / release	DUOJET	DN50	
19	S.3	13428.6	314.3	163.4		air intake / release	DUOJET	DN50	
20	P.3	14000.0	300.0	174.2	OK	low point	-	-	
21	P.4	17000.0	420.0	95.8	OK	clearing/pipe burst protection	DUOJET	DN50	
22	S.5	17600.0	416.0	36.1		air intake / release	DUOJET	DN50	
23	S.5	18200.0	412.0	36.4		air intake / release	DUOJET	DN50	
24	S.5	18800.0	408.0	36.8		air intake / release	DUOJET	DN50	
25	S.5	19400.0	404.0	37.1		air intake / release	DUOJET	DN50	
26	P.5	20000.0	400.0	37.4	OK	low point	-	-	



The results of the computation can be printed from the input and results page via the Print key. It can also be saved as a pdf-file. The results pages provide a clear overview of the performance specifications indicated and the graphic and tabular representation of the results.

Sizing of air valves

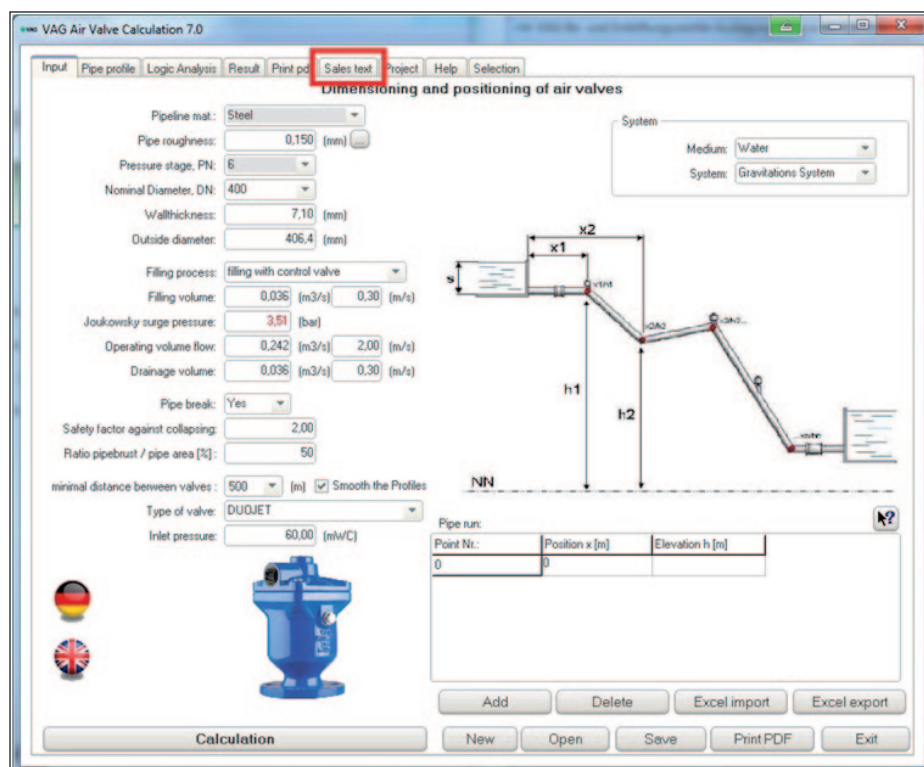
Project:
Project note:
Project date: 23.02.2012
User name: a

Input:

Pressure rate, PN:	6	[bar]	Medium:	Water
Nominal size, DN:	400	[mm]	System:	Gravitations System
Material:	Steel			
Wallthickness:	7,10	[mm]		
Outer diameter:	406,4	[mm]		
Filling:	filling with control valve			
Q Filling:	0,024	[m3/s]		
Calculated pressure surge:	2,34	[bar]		
Anti Surge Orifice:		[mm]		
Q Operation:	0,242	[m3/s]		
Q Clearing:	0,036	[m3/s]		
Rupture Calculation:	Yes			
Safety factor:	2,00			
Rupture size:	50	[%]		
buckling pressure pipeline:	-11,305290	[bar]		
min. Distance:	500	[m]		
Valve type:	DUOJET			
Headpressure:	60,00	[mWC]		

Via the “Sales texts” button you will get the corresponding sales texts as a Word file.



The calculations of the programme are limited to the selection of the suitable valve size and a technically adequate positioning of the valves in the pipeline system.

To keep the number of input data low and thus ensure simple and easy handling, the application range of the software is limited to gravitation systems without critical peaks.