



Operating Manual for AV PRO

2016 Edition

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1. Introduction in Air-Pro World

Dorot is presenting you the **Air-Valve PRO (AV-PRO)**, an online design tool for the hydraulic engineer.

Air-Valve PRO is designed to allow a designer of water networks an easy-to-use & comprehensive solution for size selection of air valves and their preferred locations along the pipeline.

Air-Valve PRO's algorithm is based on Dorot's extensive knowledge and expertise gained over more than 70 years of experience, along with up-to-date Air Valve R&D - as well as advanced aerodynamic equations.

Since every system is different and engineers may incorporate personal approaches from safety margins, commercial considerations to design priorities, Air-Valve PRO was especially designed to be user friendly, in form and content editing, allowing intuitive manual modifications, including moving, adding, deleting, increasing and decreasing sizes - using a few simple mouse clicks.

All design results may be saved on the engineer's computer, so that previous projects can always be edited whenever needed.

Air-Valve PRO's results are both graphic and numeric, thus allowing the engineer to add them to the general and detailed network design, and to the project's documentation.

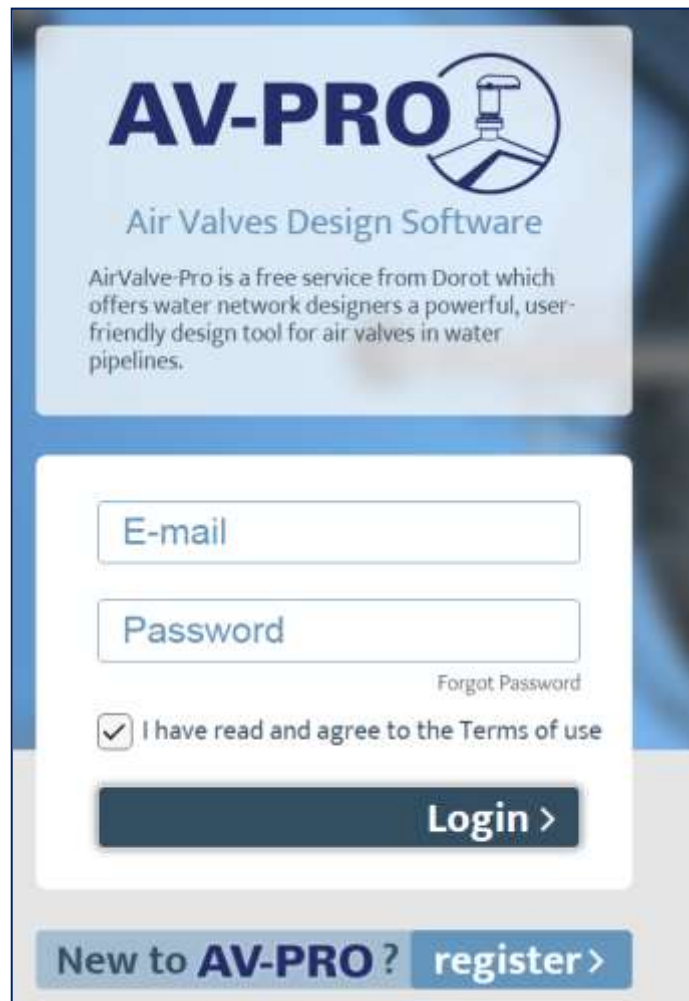
Air-Valve PRO is free to use following a short registration process. No licensing or payments are required. Just internet connection!

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The 1st step you need to take is registering for AV-PRO:

The program is located in the internet server. Nothing should be copied to the computer hard disk.

- Enter www.airvalve-pro.com in your browser
- New user: In the log-in screen, click “New to AV-Pro”
- Fill-in and submit the required data in the “Register” form.
- Register your E-mail address and password, for future login.
- Whenever you want to use the program, your registered E-mail and password will be found automatically.

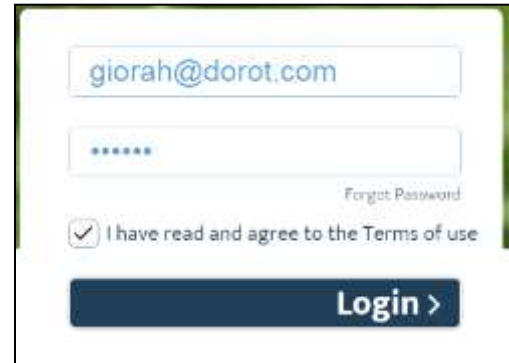


The screenshot shows the AV-PRO login and registration page. At the top, the AV-PRO logo and 'Air Valves Design Software' are displayed. Below this, a descriptive paragraph states: 'AirValve-Pro is a free service from Dorot which offers water network designers a powerful, user-friendly design tool for air valves in water pipelines.' The main form contains an 'E-mail' input field, a 'Password' input field with a 'Forgot Password' link, and a checked checkbox for 'I have read and agree to the Terms of use'. A dark blue 'Login >' button is positioned below the form. At the bottom, a blue button labeled 'New to AV-PRO? register >' is visible.

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2. Running AIR-PRO

2.1 Open Air-pro. Your registration details (E-mail address and password) will appear. Enter a name of the new Design, and then select the source of the design data:



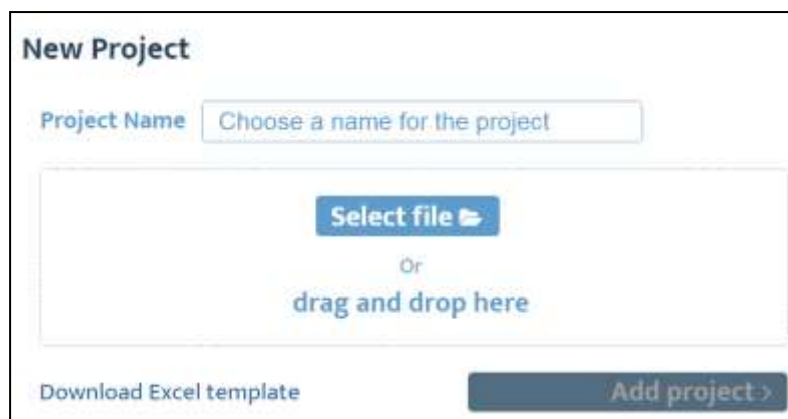
The screenshot shows a login form with the following elements: an email input field containing 'giorah@dorot.com', a password input field with six asterisks, a 'Forgot Password' link, a checked checkbox for 'I have read and agree to the Terms of use', and a dark blue 'Login >' button.

1) Data source is an **AutoCAD file**: Click “select file”, find the DXF file, OPEN it as described in [Section 3](#) (pages 5-7), then click “Add project”.

2) Data source is an **EXCEL File**: Click “Download Excel template”. Follow the instructions in [Section 4](#) (page 8). When the template was filled, save it using the project name.

2.2 Now click “select file”, mark the saved file and then click “Add project”.

2.3 Move to the design process, [Section 5](#) (page 10)



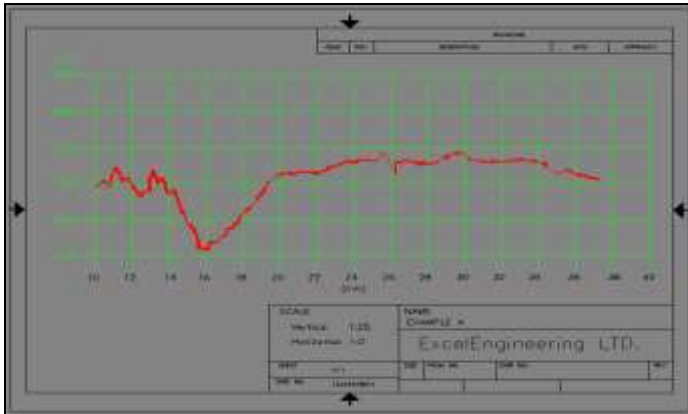
The screenshot shows the 'New Project' form with the following elements: a 'Project Name' label and a text input field with the placeholder 'Choose a name for the project', a large 'Select file' button with a right-pointing arrow, the text 'Or drag and drop here' below it, a 'Download Excel template' link, and a dark blue 'Add project >' button.

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3. Preparing AutoCAD (or compatible software)

3.1 Use a vertical cross-section of a pipeline in *.DWG drawing as a design source *Example:* <http://www.dorot.com/DAV/AV-Pro%20sample.dwg>

3.2 Open a DWG file:



3.3 Register the horizontal and vertical scales: Divide the drawing measurement (using the "Inquiry > Distance" tool) by actual length or height difference or the reference section.

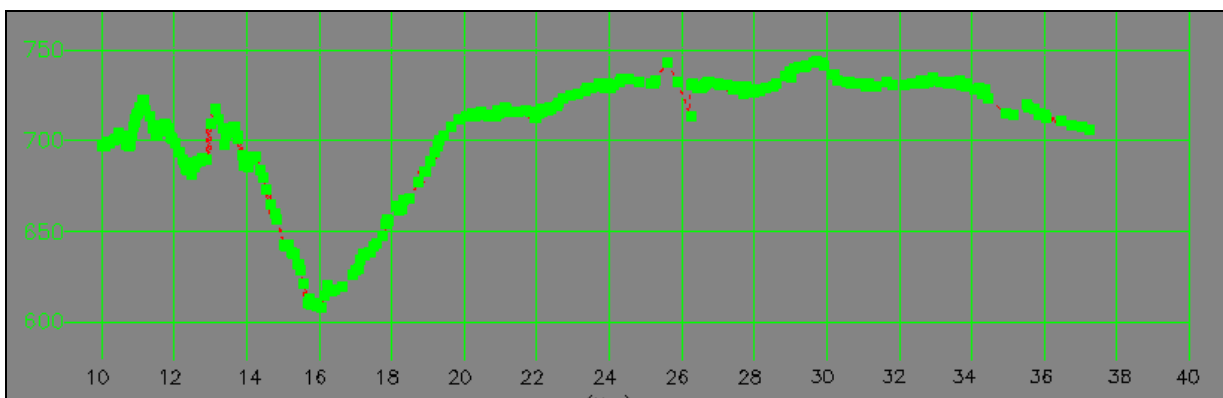
Example: Vertical elevation [700-600]=100m. Drawing measurement=2500, scale 2500:100=25; Horizontal distance [40000-10000]=30000m. Drawing measurement =15000, scale 15000:30000=0.5

3.4 Register the elevation of the start point of the pipeline, 700m in this example

3.5 Register the start distance of the pipeline, 10000m in the example.

3.6 Make sure that the pipeline is drawn as a continuous polyline.

In case it is not -"join" the separate sections (use PEDIT command, select a section and key in "J" to join all sections).



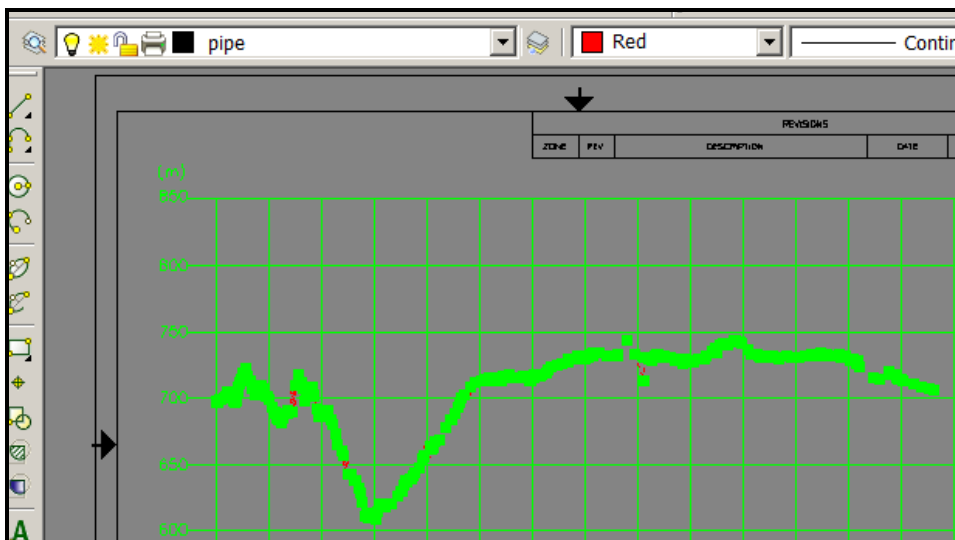
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3.7 Create a new layer; name it a unique name such as "PIPE"

28	SUBADOTPROJ				170	DASHED	Default	Color_170
29	Terreno_natural				30	Continuous	Default	Color_30
30	TEXT				Yellow	Continuous	Default	Color_2
31	Title Block				White	Continuous	Default	Color_7
32	NewLayer1				White	Continuous	Default	Color_7

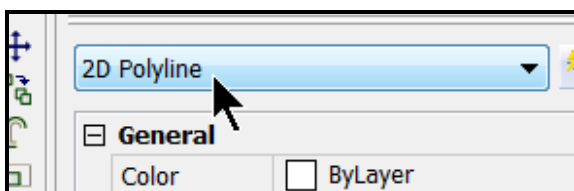
27	1IMAGE-BARRAMENDES				99	Continuous	Default	Color_99
28	RAMALDESAT				Green	DASHED	Default	Color_3
29	Terreno_natural				30	Continuous	Default	Color_30
30	Title Block				White	Continuous	Default	Color_7
31	pipe				White	Continuous	Default	Color_7

3.8 Allocate the "pipe" layer (or other unique layer-name selected) to the L-section polyline.



Verify that the L-section polyline is the only feature in that layer.

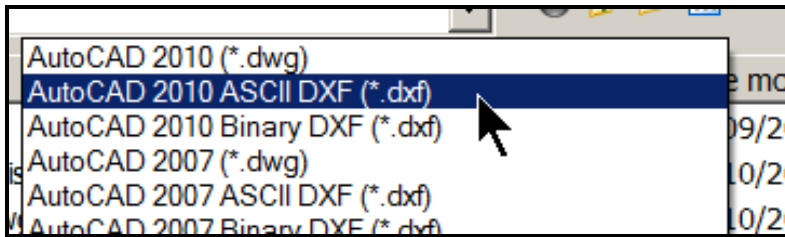
Remark: In the case the line is "2D polyline"- it must be converted to "Polyline". Do the follows: "Explode", and then: PEDIT, convert a section to a polyline, key-in "J" and then "all" - to join all sections to a single polyline.



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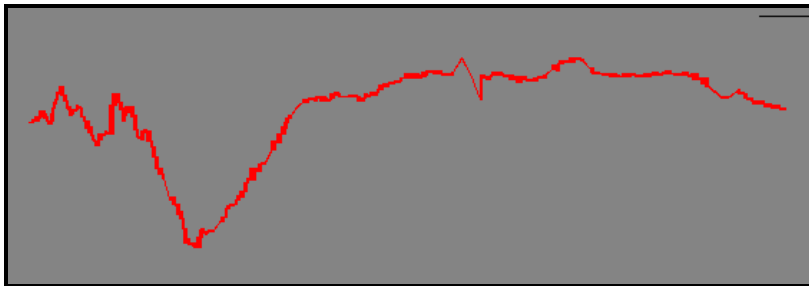
3.9 SAVE AS the drawing in ASCII DXF format. The file is now ready for processing in Av-Pro.

Example: <http://www.dorot.com/DAV/AV-Pro%20sample.dxf>



3.9 Large files may require very long uploading time to the AV-Pro. Therefore, It is advisable to copy the polyline only to a new file.

Example: <http://www.dorot.com/DAV/AV-Pro%20sample%20simplified.dxf>

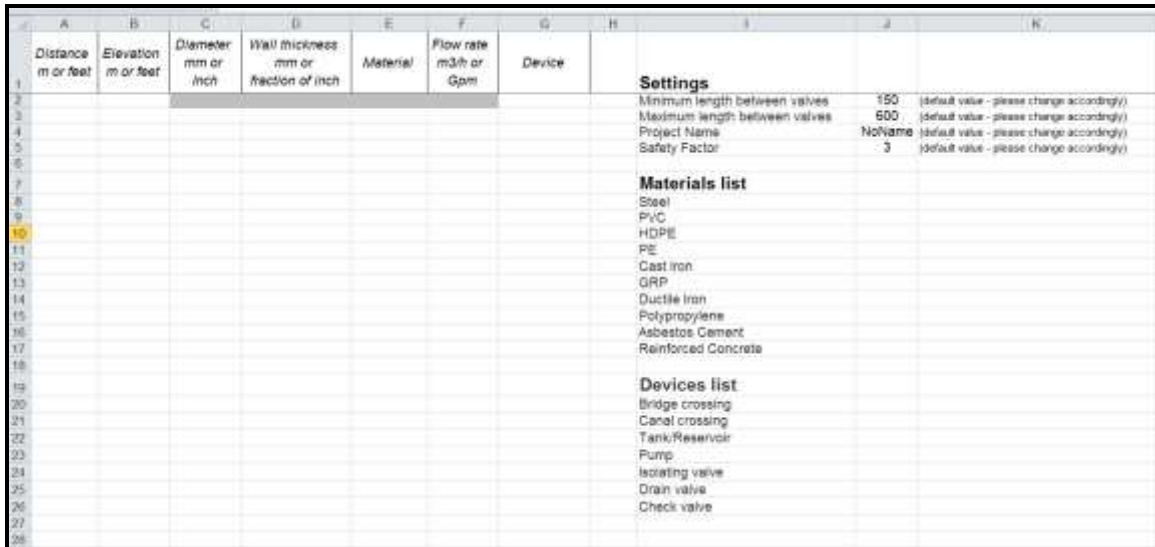


Go to [Section 5](#) (page 10) for uploading the file to AV-Pro.

4. Preparing an EXCEL table of distance / elevation

4.1 Open the EXCEL template.

The following sheet will be downloaded to your computer:



A	B	C	D	E	F	G	H	I	J	K
Distance m or feet	Elevation m or feet	Diameter mm or inch	Wall thickness mm or fraction of inch	Material	Flow rate m3/h or Gpm	Device				
								Settings		
								Minimum length between valves	150	(default value - please change accordingly)
								Maximum length between valves	600	(default value - please change accordingly)
								Project Name	NoName	(default value - please change accordingly)
								Safety Factor	3	(default value - please change accordingly)
								Materials list		
								Steel		
								PVC		
								HDPE		
								PE		
								Cast iron		
								GRP		
								Ductile iron		
								Polypropylene		
								Asbestos Cement		
								Reinforced Concrete		
								Devices list		
								Bridge crossing		
								Canal crossing		
								Tank/Reservoir		
								Pump		
								Isolating valve		
								Drain valve		
								Check valve		

4.2 Copy the distance column of your Excel data sheet to the X column and corresponding elevation column to the Y column of the template.

[Link to a demo template: see DEMO sheet in:
http://www.airvalvepro.com/api/xlsx_template](http://www.airvalvepro.com/api/xlsx_template)

4.3 Fill the “settings” in the right-side columns:

4.3.1 Minimal and maximal distances between Valves (determined by the topographic characteristics of the specific line).

Settings	
Minimum length between valves	150
Maximum length between valves	600
Project Name	NoName
Safety Factor	3

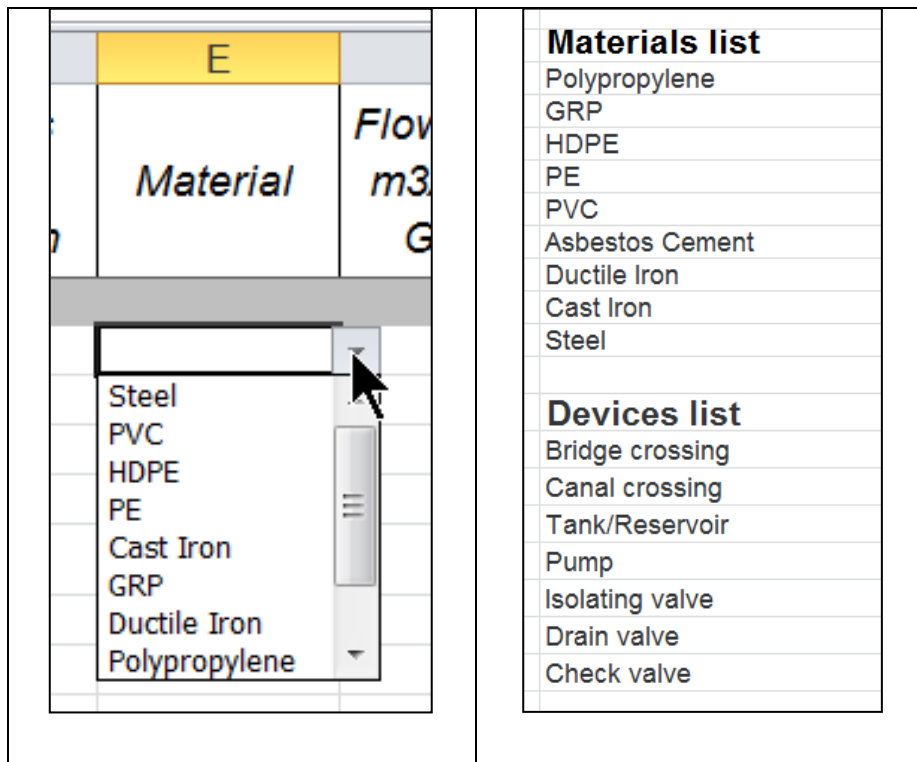
4.3.2 Project name - specific name of the design

4.3.3 “Safety Factor”- an integer, which divides the theoretical Collapse pressure (allowed negative pressure of the pipe). Increasing this value improves the safety of the design- and may increase the size of selected valves.

4.3.4 Min. / Max. Values safety factor will automatically copied to the design database of the project.

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4.4 Copy the relevant pipe material and device item from the lists in the right-side of the template, or use the drop-down menu which can be opened in the relevant column (see example below). In the case the material is changed at some point along the pipeline, paste its name in the relevant distance row.



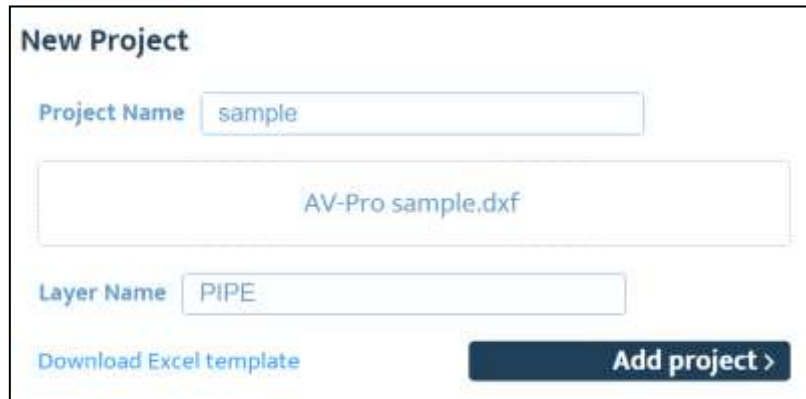
Same applies to a device, which is intended to be installed at a certain location.

4.5 Name the template file and save it in your hard disk.

Go to [Section 5](#) (page 10) for uploading the file to AV-Pro.

5. Processing the design source files

5.1 Browse to the www.airvalve-pro.com internet domain. The following screen will appear:



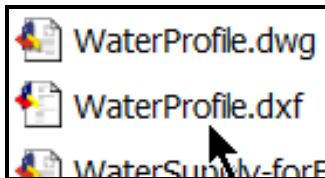
5.2 Name the new project, and Select the data source:

5.2.1. For input data via an Excel file - **click the "select file"**. Find your saved Excel template file and open it.

NOTE: The data of the EXCEL table are copied to the "settings" screen (page 6-7 & 11).

Link to a demo template: see DEMO sheet in
http://www.airvalvepro.com/api/xlsx_template

5.2.2. For input data via a DXF polyline - **click the "select file"**. Select the saved DXF file and click "Open":



The screen will accept the file and automatically will select the "PIPE" layer.

NOTE: In case a different name was assigned to the layer – key it in instead of "PIPE".

Link to a demo template: see DEMO sheet in
http://www.airvalvepro.com/api/xlsx_template
<http://www.dorot.com/DAV/AV-Pro%20sample%20simplified.dxf>

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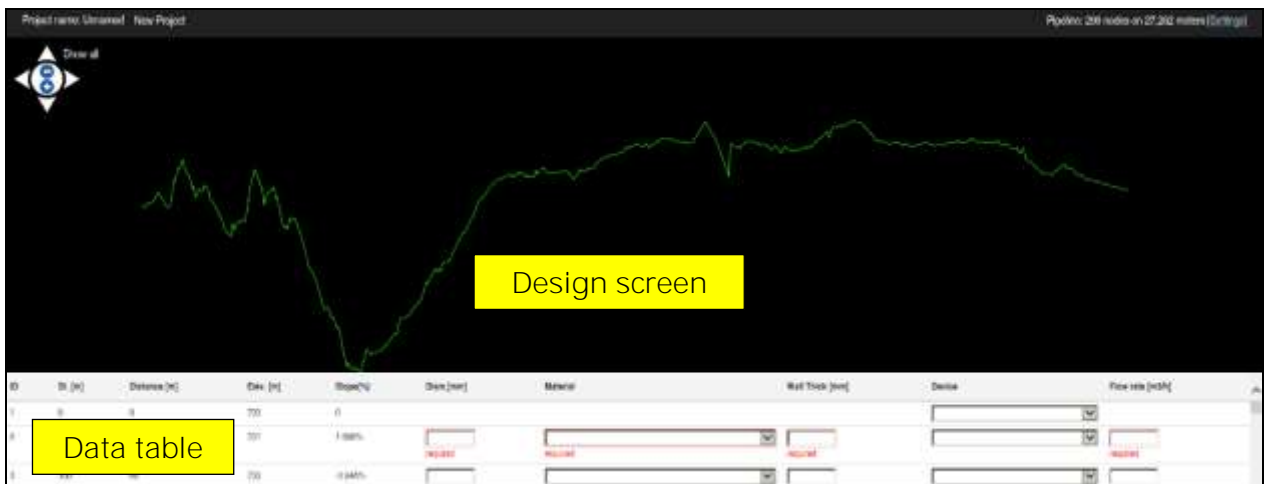
5.3 Click **“Add project”**

5.4 Enter design parameters in the Settings screen (Example-DXF file):



Comments: USIS = American units (Inch / Feet / Gpm). Use the tooltips [?] for clarifications of the required input.

5.5 Click **“SAVE”**. The **design screen** and **data table** will appear within few seconds, depends on the file size and speed of the internet connection:



ID	DI (in)	Distance (ft)	Dia. (in)	Slope (%)	Den. (mm)	Material	Wall Thick. (mm)	Device	Flow rate (m3/h)
1	0	0	700	0					
2	0	0	700	1.00%	10000	10000	10000	10000	10000
3	0	0	700	0.00%					

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5.6 Data table: Fill the required cells- see example below (EXCEL data are filled automatically):

Diam.(mm)	Material	Wall Thick (mm)	Device	Flow rate (m ³ /h)
			Pump	
500	STEEL	5		800

Drop-down menus of “pipe material” and “device” enable convenient selection of these items.

Note: the data entered in the top row, except the “device”, is automatically assigned to the cells below in the same column.

In case there are changes in one or more of the data items along the pipeline, find the relevant change point (distance from the start - “St. (m)” and enter the modified value in the cells in its row.

Only the modified value should be written, and only at the node at which is changed.

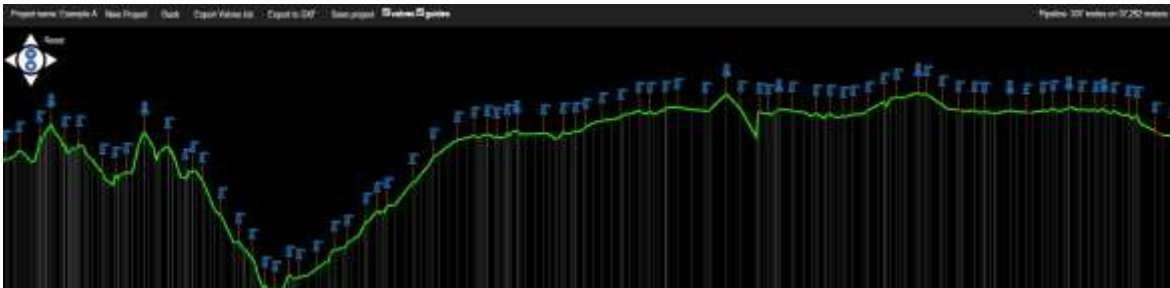
Example: Different pipe material and wall thickness start in station #244, ch.29741

244	29,741	40	745	-1.2%		GFP	25
-----	--------	----	-----	-------	--	-----	----

When completed, CLICK:



5.7 The program draws the designed air valves on the pipeline, following the initial settings:



6. Design Screen Options

6.1 Position and elevation of a valve (or a selected point on the line) are indicated in the top right corner of the screen, when you move the cursor to the valve icon.

6.2 The screen- control, located in top-left corner, allows Zoom-in and out by clicking + / - .

- Zooming can also be executed by the scroll wheel of the mouse, + Ctrl key.
- The pipeline can be moved up- or down, right or left on the screen, using the respective arrowhead.
- Up /down moving of the pipeline may also be executed by the scroll wheel of the mouse.
- Left/Right moving of the pipeline may also be executed by **"Shift" + scroll wheel**
- **"Reset"** returns the design drawing to initial size and position on the screen.



6.3 Left- click on any valve icon moves the table so the top row is the station of the specified valve.

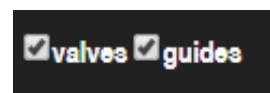
Note: precision of row finding requires, mostly, zoom-in of the screen.

6.4 Click on an "ID" on the table, moves the design screen to the relevant valve location - and, automatically, zoom-in:

ID	St. [m]
60	12,290
61	12,290



6.5 One can switch ON and OFF the designed valves and the distance guidelines, by checking or unchecking the relevant tabs on top of the screen:



6.6 The design screen can be increased, the table decreased, (and vice-versa) by left-clicking a button, located in the bottom right corner of the screen. It enables full- view of the line and valve sites at high zoom.



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7. Manual modification of the automatic design

7.1 Deleting a Valve:

a) Move the cursor to the valve you want to delete:



b) Right click, a dropdown appears. Click on "Delete valve":



7.2 Moving a valve to a different location

a) Move the cursor to the valve you want to move:



b) Left click, hold and drag the valve to new site:

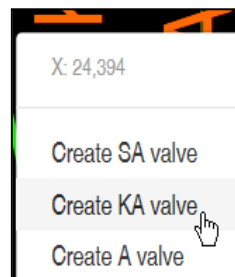


7.3 Adding a valve:

a) Move the cursor to the added required location:



b) Right click & Select the preferred valve in the drop-down menu:

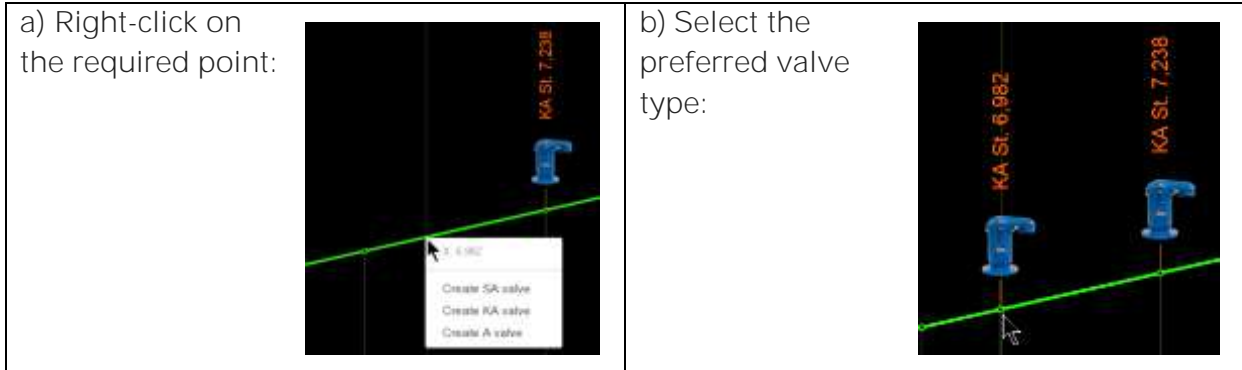


b.1) The valve will be added to the drawing:

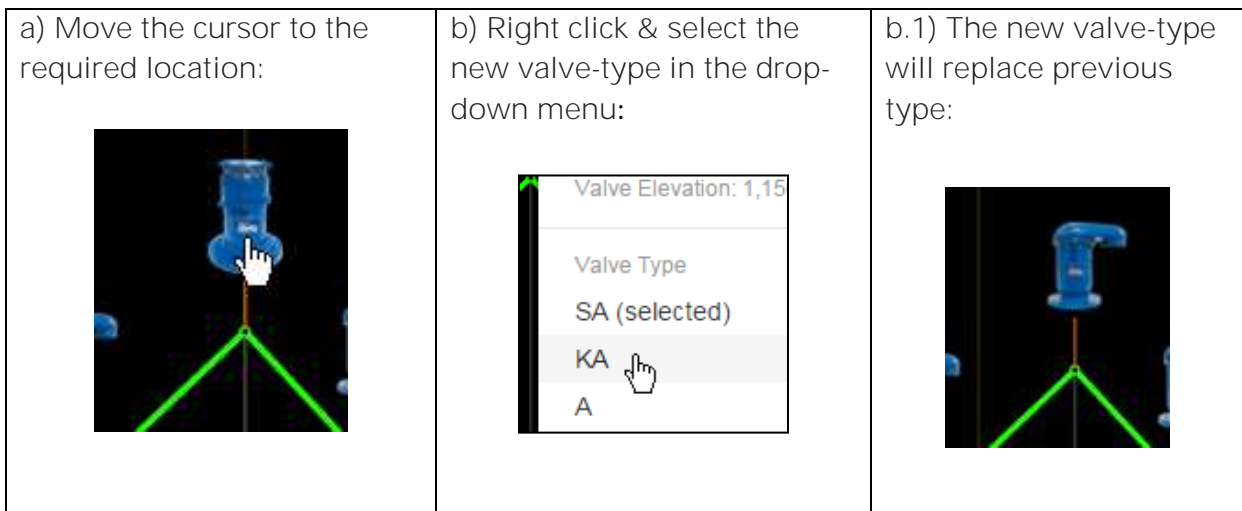


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7.4 Adding a valve location in an un-defined point along the line:



7.5 Changing the valve type:



7.6 General Design modifications:

7.6.1 Clicking “Back” (top left corner) cancels all manual modifications, and returns the design screen and table to original conditions.

7.6.2 Clicking “Settings” (top right corner) returns to the “Setting” screen ([page 6-8](#), [page 11](#)) where the initial parameters can be modified.

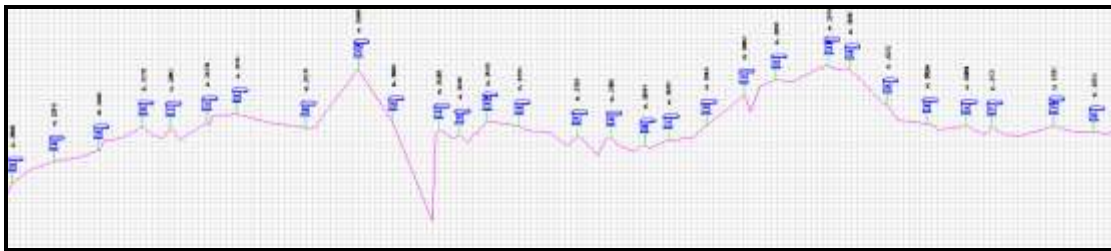
8. Design Output

Various output options are available. All are activated using the tabs in the top-left corner of the screen:

8.1 **“Export to DXF”** creates an icon in the bottom-left corner of the table area.

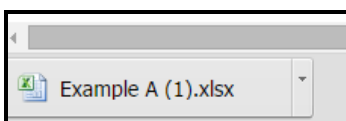


Clicking on this icon generates a DXF drawing of the pipeline and the designed valves that can be opened and edited by any dwg/dxf editor (such as AutoCAD):



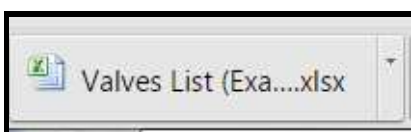
The DXF file is saved, automatically, in the “Downloads” library of the “Windows”.

8.2 **“Save project”** creates an icon on the table area. “Save project” creates an icon on the table area.



Click the icon to open an EXCEL sheet, which includes all data of the designed project. The file is saved, automatically, in the “Downloads” library of the “Windows”.

8.3 **“Export valves list”** generates an EXCEL file that lists the designed valves. It can be opened by clicking on the icon, which appears in the bottom-left corner of the table area.



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Clicking the icon opens the valves list:

	A	B	C	D	E	F	G
1	Project:	Example A					
2	Date:	08:03, Apr 02 2015					
3							
4				Option A		Option B	
5	Station	Distance	Elevation	Quantity	Valve	Quantity	Valve
6	10001	1	700	1	DAV-MH-2-KA	1	DAV-MS-3-KA
7	10160	159	702	1	DAV-MH-2-KA	1	DAV-MS-3-KA
8	10460	300	708	1	DAV-MH-2-KA	1	DAV-MS-3-KA
9	10900	440	715	1	DAV-MH-2-KA	1	DAV-MS-3-KA
10	11140	240	726	1	DAV-MH-2-KA/SA	1	DAV-MS-3-KA/SA
11	11440	300	740	1	DAV-MH-2-KA	1	DAV-MS-3-KA

The file is saved, automatically, in the “Downloads” library of the “Windows”. Furthermore, it can be saved in the project library and edited.

8.4 Clicking on a valve name open a menu of technical publication, relevant to the selected valve model. Each item is activated by left-key click of the mouse:

8.4.1 Catalog of the specific valve type

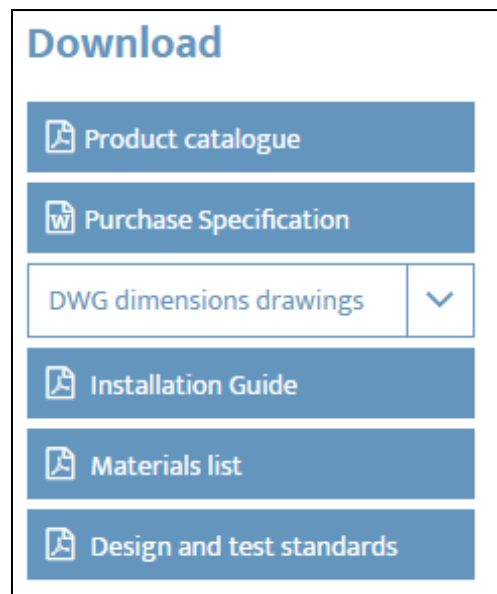
8.4.2 Detailed technical specification of the selected valve. This document is in *.DOC format, so it can be copied and pasted to the general project specs.

8.4.3 Top, side and front views of the selected valve. These vies are in AutoCAD DWG format, at 1:1 scale, to be copied by the designer to various detailed drawings of the project.

8.4.4 Recommendation of installation

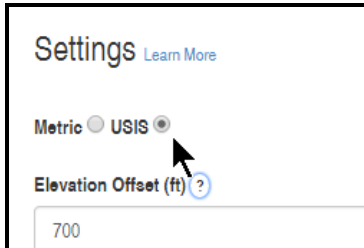
8.4.5 Cross-section and standard materials list of the selected valve

8.4.6 General design and test standards of the valve - a useful information for the design engineer.



9. Design in USIS (American) dimensions

All steps are similar to the metric-units procedure, after defining the required work-units in the “Settings” screen (Paragraph 4.3, [Section 4](#), page 8).



The elevation and distance offset values should be feet units. The table units will appear in the USIS system: Diameter and Wall thickness (Inch), Flow rate (Gpm).

Important comment: *the pipe wall thickness which is indicated, normally, by fractions of an inch (example 3/16") - must be entered as decimal value (example: 3/16= 0.1875).*

10. Uploading of previous projects

Old projects, which were saved as described in Paragraph 8.2 ([Section 8](#), page 16), can be uploaded, inspected and modified.

The EXCEL table, created by the program, is located automatically in the “Downloads” library (moved manually to another library). When you want to upload it, use the normal procedure described in [Section 5](#) (page 7). Open the saved EXCEL file as a source.

11. Design concepts of DOROT “AV-PRO” software

11.1 Sizing of air valves

11.1.1 The criterion of air valve size is the orifice cross section, which enables sufficient inflow of air when the pipeline is drained, and the pipeline enters sub-atmospheric pressure.

11.1.2 At this condition, each volume of drained water is replaced by equal volume of air.

11.1.3 The program calculates the collapse pressure of the pipe (the internal negative pressure, which may cause the pipe to yield to the higher external atmospheric pressure). It applies a safety factor (default x 3, can be modified by the user), and then calculates the orifice size which eliminates the risk of pipe collapsing due to negative pressure.

11.1.4 In the case the calculated collapse pressure is more than 2.5m (3.6psi), the selected orifice will be the one which allows the volumetric inflow of air, which replaces the normal water flow rate, at a ΔP of 2.5m.

This value is applied even if the pipe cannot collapse at all (full cavitation). However, in case of a pipe **that may collapse at smaller ΔP** , the program will select a larger orifice which prevents exceeding the ΔP limit.

***Note:** Collapse pressure of a pipe is calculated by its diameter, wall thickness and material.*

In order to enable the user the option to impose his preferences on the automatic software design, there are user- friendly options for manual size modifications in the EXCEL output table.

11.2 Locating air valves on the pipeline

Generally, the program follows AWWA C-512 standard. In order to provide a practical design, the user should define the maximal and minimal spacing he allows between valves.

Air valves are located at the following priority:

11.2.1 Elevated point (a “peak”)

11.2.2 Ascending section, where the slope grade becomes shallower

11.2.3 Descending slope, where the slope grade becomes steeper

11.2.4 When there are two points, which are nearer than the user-specified minimal distance- the program selects the higher one.

11.2.5 In case of a uniform- slope section, that is longer than the user- specified maximal distance, valve(s) will be located in the middle or evenly- distributed.

11.2.6 Exceptional case is a very steep downhill slope, where the water flow velocity is insufficient to drag the air downstream (sub-critical velocity).

The program calculates the velocity in each section, and in case it finds it to be sub-critical, an automatic valve (which drains air under normal operating pressure) will be located at the upstream side of the section, where the air may accumulate. In this case, the program disregards the user definition of max/min distances.

Note: Sub-critical velocity sections are painted red in the design screen.



In order to enable the user the option to impose his preferences on the automatic software design, there are user-friendly options of manual site modifications, adding or deleting valves while the design screen is activated. (Refer to [Section 6](#), page 13).

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