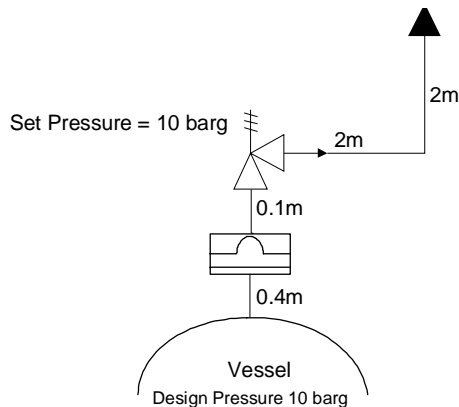


This short guide will show you how easy and quick VisualAdrian is to use. A relief valve has been sized to relieve toluene (in the worst case) from a vessel and we are going to check that the pressure drops upstream & downstream of the relief valve are acceptable according to the guidelines recommended by ABB Consulting i.e. that the upstream pressure drop is <3% of the Set Pressure and the downstream pressure is <10% of the Set Pressure.



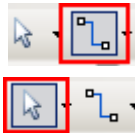
- Inlet contraction is abrupt.
- Vessel contains Toluene.
- Pipes upstream of the Relief Valve = 2" Schedule 40
- Pipes downstream of Relief Valve = 3" Schedule 40
- All pipes are slightly corroded mild steel
- Bursting disc has no vacuum support.
- Bend is 90° with r/d=1.

Okay let's get going.

1. Click **Start | Programs | PEL | VisualAdrian**. Click **Enable Macros** and the VisualAdrian splash screen appears briefly on the screen.

The first thing we need to do is add the Vessel and the Exit and connect them together.

2. Drag & drop the **Vessel** onto the bottom of the drawing and then add an **Exit** to the top of the drawing **directly above** the vessel.



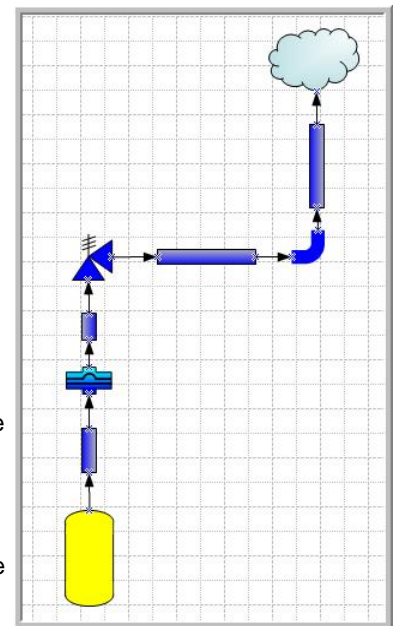
3. Click the Visio **Connector** on the top toolbar and connect the Vessel to the Exit.
4. Click the Visio **Pointer** on the top toolbar.

Next, we need to add the fittings.



5. **Drag** – but **don't drop** – the **straight** from the stencil and position it over the pipe connecting the vessel to the exit. When the scissors appear **drop** the straight. The straight should then be inserted into the pipe.

6. Repeat the above for the **bursting disc**, a **straight**, and the **relief valve**. Next drag the **Exit** to the top right-hand corner of the drawing. The pipe should now be the same shape as the drawing opposite. Now add another **straight**, the **bend**, and the final **straight**. When inserting the relief valve and the bend make sure both connection points turn red. You can move the fittings up and down then pipe by clicking on them and moving them with the mouse. You can also re-position the pipe by clicking on it and then dragging the little **green X**.

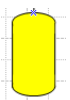


After a little practice, your drawing should look something like the one opposite so now is a good time to save it.




7. Click the **Save** button on the Visio toolbar and save the data in **VisualAdrian.VSD** on the **C:** drive

Next we need to add the process data. Let's start with the Vessel



8. **Double-click** on the Vessel to bring up the *Vessel Editor*.
9. Check **Abrupt** for the contraction type, and define the input by **Flow** with a value of **2.2 kg/s** and an estimated inlet pressure of **11 barg** (i.e. the Set Pressure + 10% overpressure)

We can use the Physical Property Calculator to calculate the physical properties we need for Toluene.

10. Enter a Stagnation Temperature of **229°C** and then click  to launch the Physical Properties Calculator.
11. When the *Physical Property Calculator* appears, click **Add Component**.
12. When the *Select Components from Databank* window appears, type **TOL** in the *Search for Name* box, click on **TOLUENE** in the list, then click **Add to Stream**, and then **Close** to return to the Physical Properties Calculator.

Note that the temperature & pressure have been transferred to the calculator so now we are ready to calculate.

13. Click **Calculate** and the physical properties are displayed in the grid. The values you should get are: -
Molecular Weight=92.14; Compressibility Factor=0.78; Isentropic Exponent=1.149; Viscosity=0.0128; Specific Heat=2087J/kg.K
14. Click on the calculated values to see the Quality Assurance associated with them. When you are satisfied with them, click **OK** to return to the Vessel Editor and then click **OK** to close the Vessel Editor.



We are now ready to enter the process data for the pipe fittings.

15. Double-click **one of the pipe connectors between the fittings** to bring up the *Edit Pipe* window.

We can enter the process data for all the fittings using this editor

16. Use the mouse to select and highlight the cells in the Roughness column, then click **right-mouse button** and select **Roughness Calculator** from the pop-up menu. Select **Mild Steel (slightly corroded)** from the list and click **OK**. VisualAdrian will paste the value back into the Roughness box for all the fittings.
17. Click the **Inlet Diameter for the first Straight** then click **right-mouse button** and select **Pipe Inner Diameter Calculator**. Select **2" Schedule 40** from the lists and click **OK**. VisualAdrian will paste the value back into the Inlet diameter box and propagate it down the pipe until it reaches the relief valve. Click the **Outlet Diameter for the Relief Valve**, click **right-mouse button** and select **Pipe Inner Diameter Calculator**. Select **3" Schedule 40** from the lists and click **OK**. VisualAdrian will paste the value back into the outlet diameter box and propagate it down the pipe to the last straight.
18. Set the **lengths** of the Straights to be **0.4m, 0.1m, 2m** and **2m**
19. For the Relief Valve, set the Minimum Flow Area = **562mm²** and the Discharge Coefficient = **0.975**
20. Finally for the Bend, click the **Value** cell next to **Basis** then **right-mouse click** and select **K-Value Calculator**. When the K-Value Calculator appears, select the **Bend** tab, set **r/d = 1**, the **Quantity=1**, click **Add** and then **OK**.
21. Click **OK** to close the Edit Pipe window.

The final input is to specify the back pressure at the Exit.



22. **Double-click** the Exit node and set the Outlet Back Pressure to **1 atm** and click **OK**.

That's it for the input. Now we're ready to calculate the results.



23. Click the **Calculate** button on the toolbar. When the calculations are complete, the results appear in the *Results of Calculation* window. Click **View Pipe Details** on the toolbar to see the detailed pressure drops through the fittings. On the *Detailed Results* window, click the **Pressure** on the toolbar to see graphically how the pressure falls through the pipe. Click **dP Relief Valve** to see the upstream and downstream pressure drops as a % of the Set Pressure of **10 barg** and an Overpressure of **10%**. These should be 2.6% and 5.8% respectively which are within the ABB Consulting guidelines.

This program is developed, maintained and supported by PEL Support Services, ABB. We run a Hotline telephone and email service to answer any queries about the PEL products. You can contact us:

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