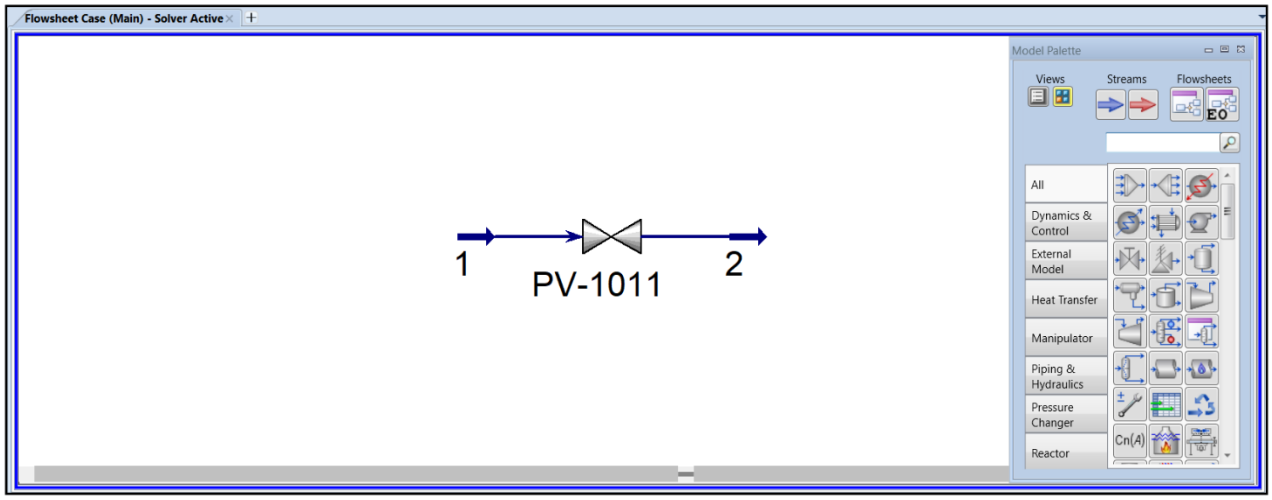
Safety Analysis in Aspen Hysys

Process description:

For fired heaters, one of the primary fuels is NG since it is more reliable and available. For a specific fired heater, 16000 kg/hr. of NG with operating pressure of 50 barg and temperature of 40C is let-down to operating pressure of 4barg via PV-1011 and later to 1 barg via another control valve to make it suitable for firing.

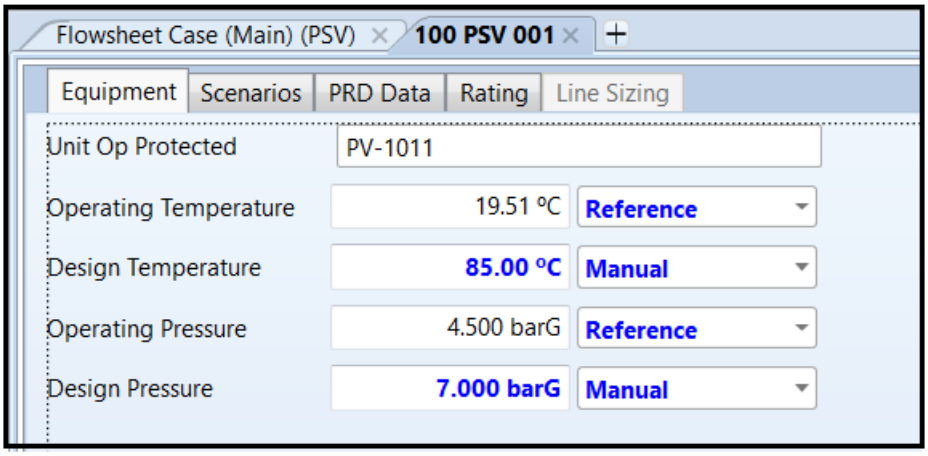


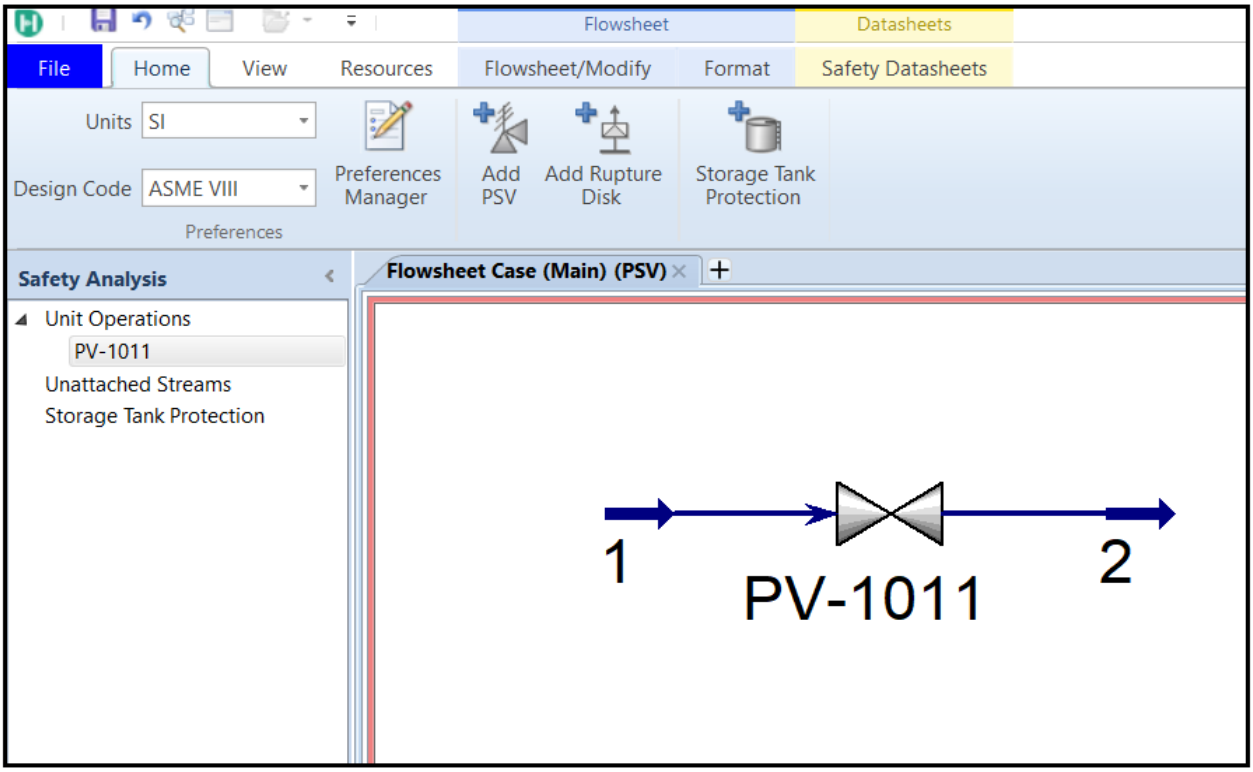
First Step: Let's check if we need a PSV

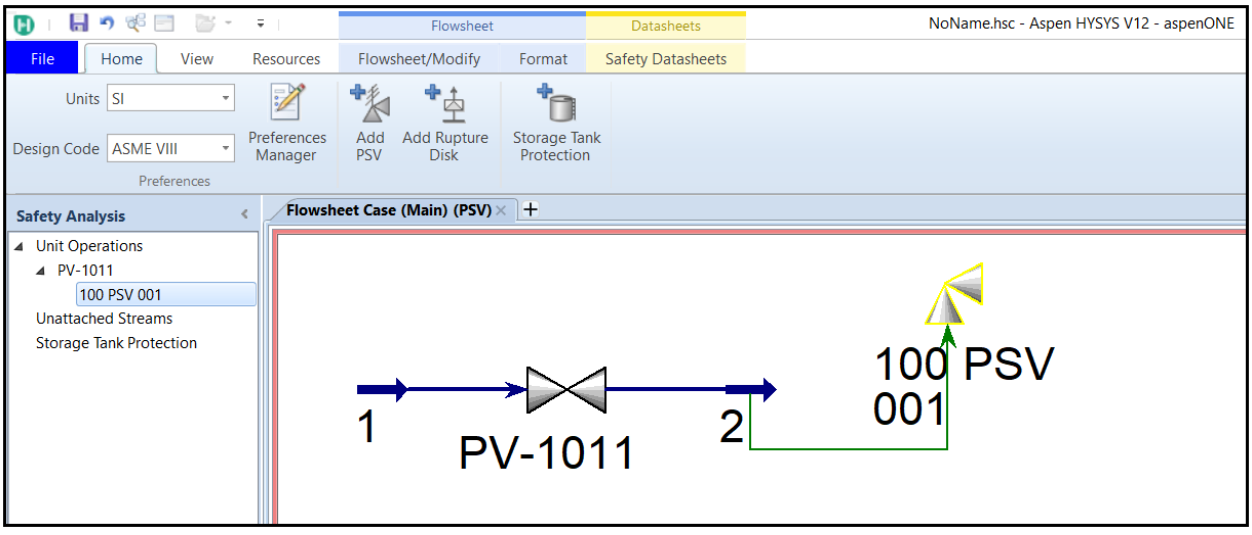
Since the difference between design pressure of high-pressure side, which is 55 barg and that of low-pressure side, which is 7 barg is high. So, we need a PSV in case of control valve failure and the possibility of high flow passage from high-pressure side to low-pressure side.

Second Step: Safety Analysis Environment

1.Go to safety analysis environment and add PSV on the outlet of control valve.
2.Double-click on PSV icon to see the following tab.




Flowsheet
Datasheets
File
Home
View
Resources
Flowsheet/Modify
Format
Safety Datasheets
Units
SI
Design Code
ASME VIII
Preferences
Preferences Manager
Add PSV
Add Rupture Disk
Storage Tank Protection
Safety Analysis
Unit Operations
PV-1011
Unattached Streams
Storage Tank Protection
Flowsheet Case (Main) (PSV)
1
2
PV-1011


Flowsheet
Datasheets
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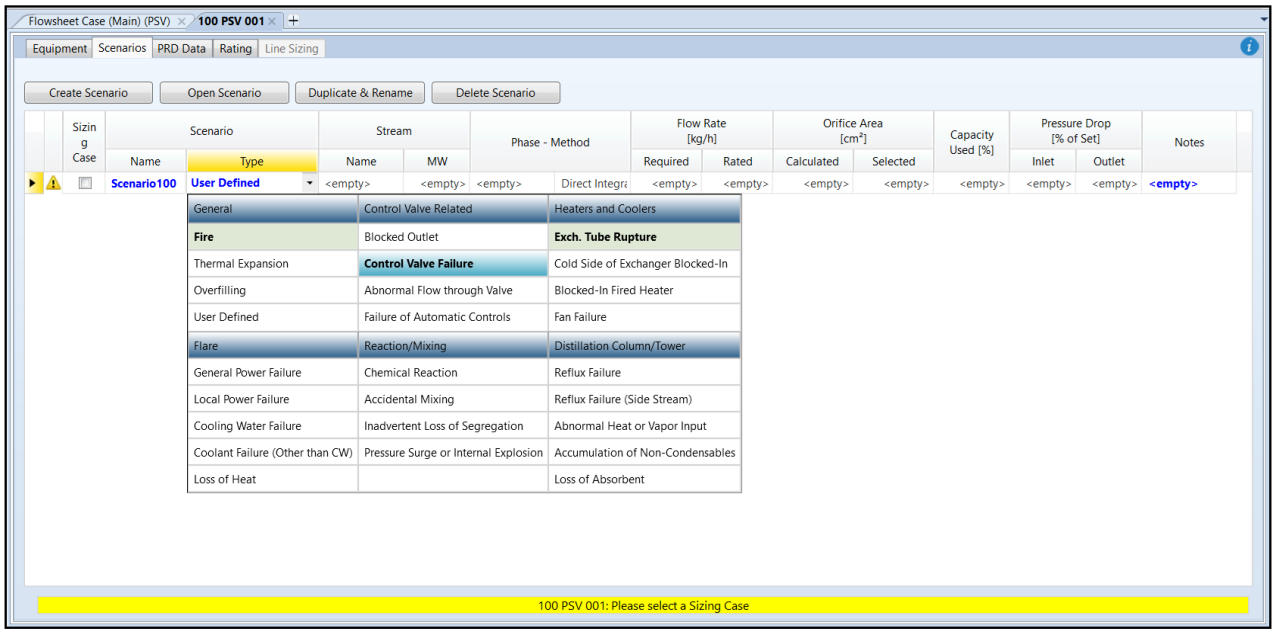
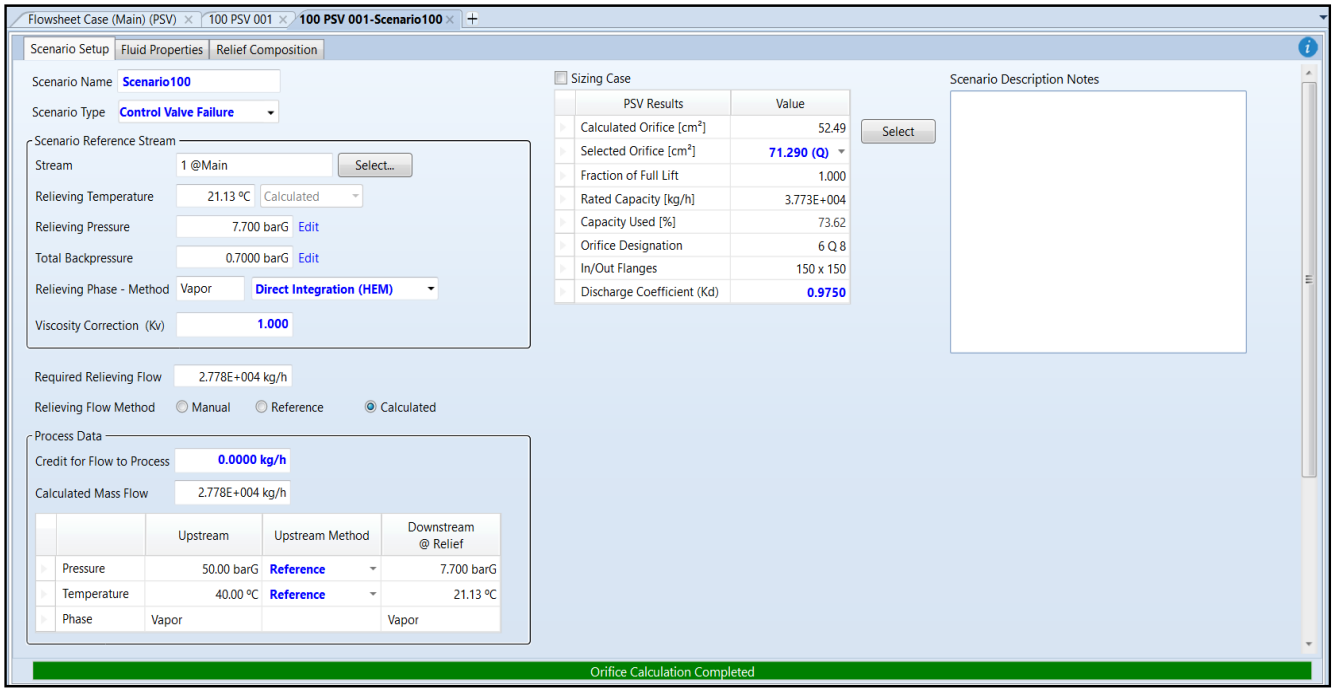
Design Code
ASME VIII
Preferences
Preferences Manager
Add PSV
Add Rupture Disk
Storage Tank Protection
Safety Analysis
Unit Operations
PV-1011
100 PSV 001
Unattached Streams
Storage Tank Protection
Flowsheet Case (Main) (PSV)
1
2
PV-1011
100 PSV 001

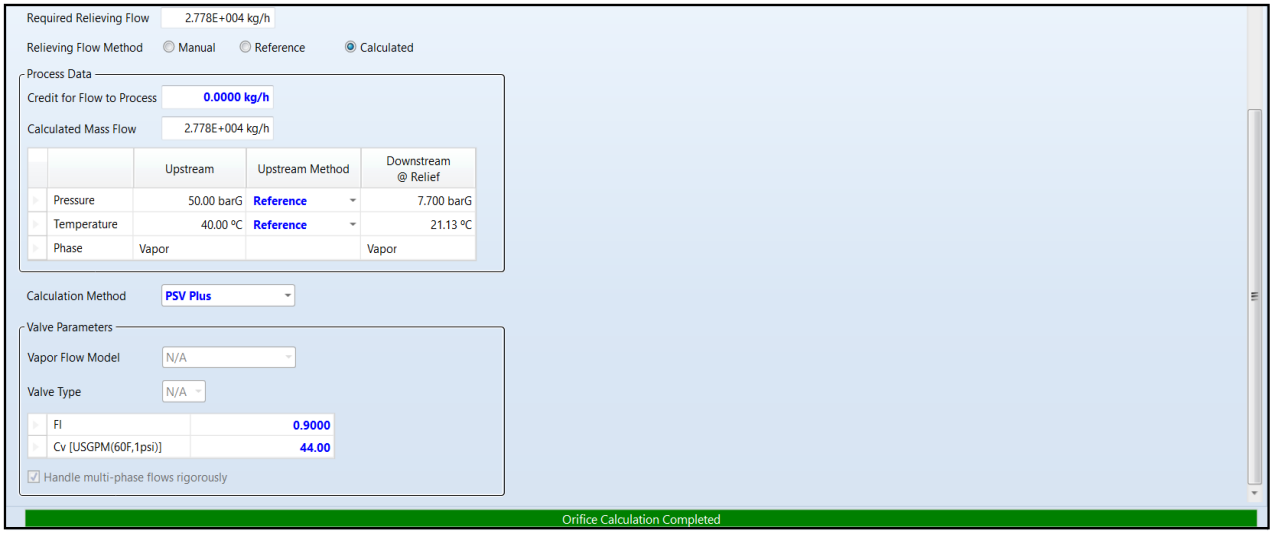
Manual means you are supposed to specify the matter while reference means the information is taken from the line, which just provide operating conditions.

3.Go to scenario tab, create a scenario and select control valve failure.

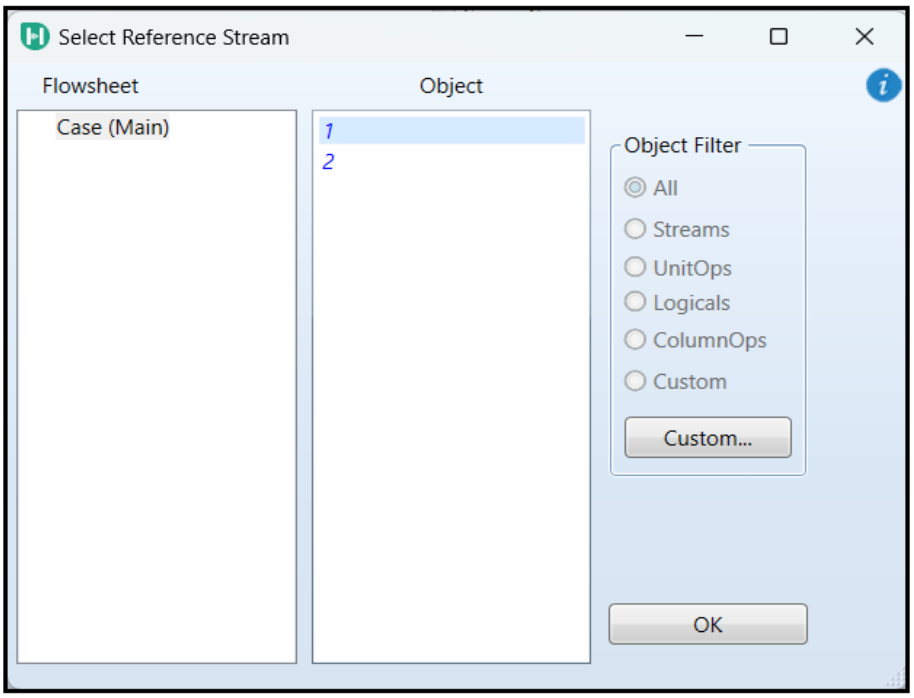


4.Now open scenario.

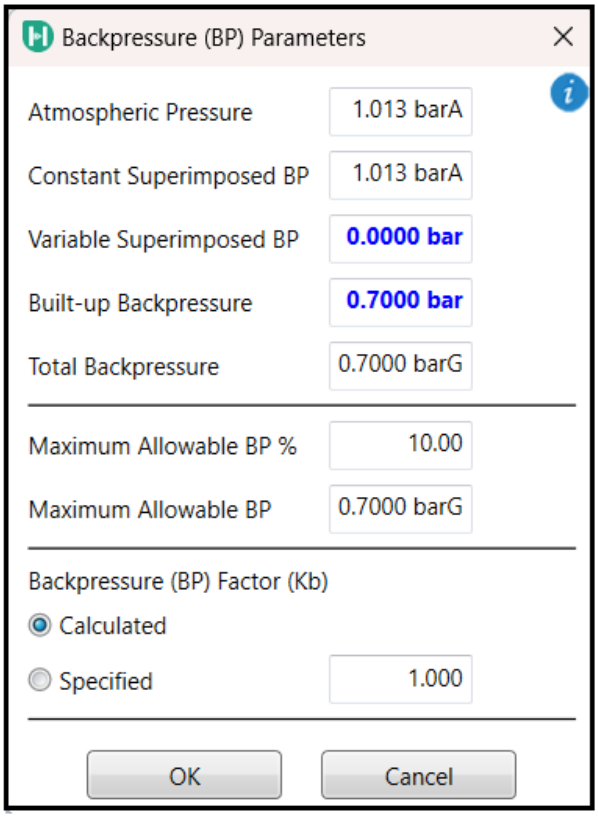




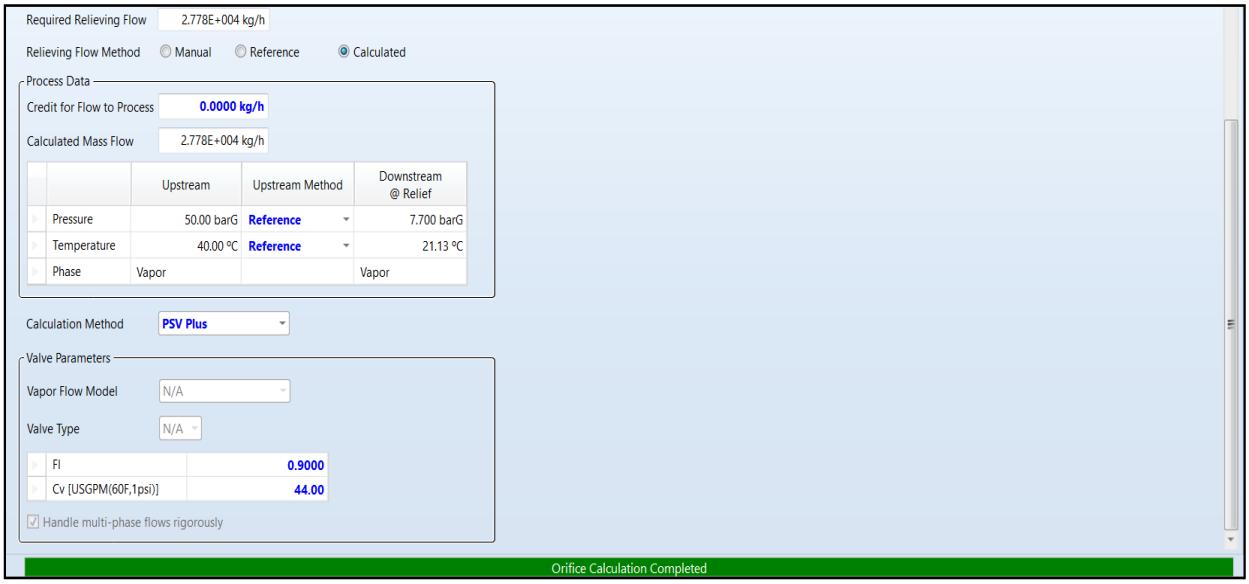
Under scenario reference stream select stream 1:



You can also change total backpressure like below:



Select relieving method to be calculated and also choose PSV plus as the calculation method. Specify the CV to be 44.

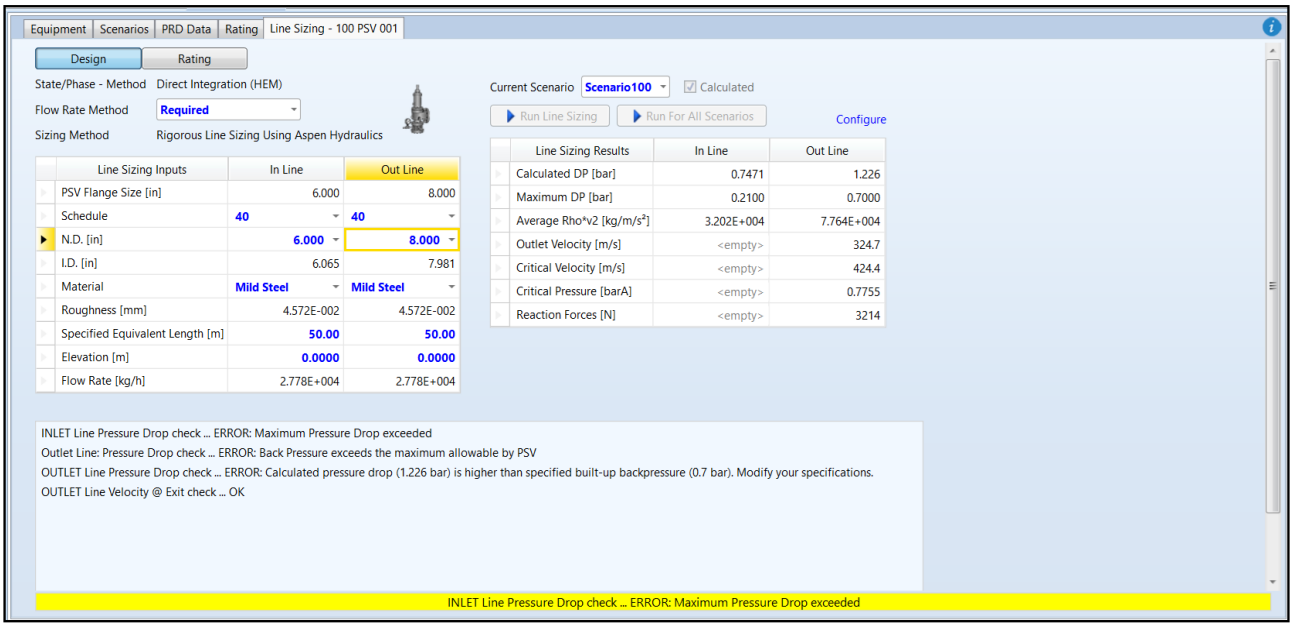


Select a bigger orifice area than calculated orifice which is 52.49 cm^2.

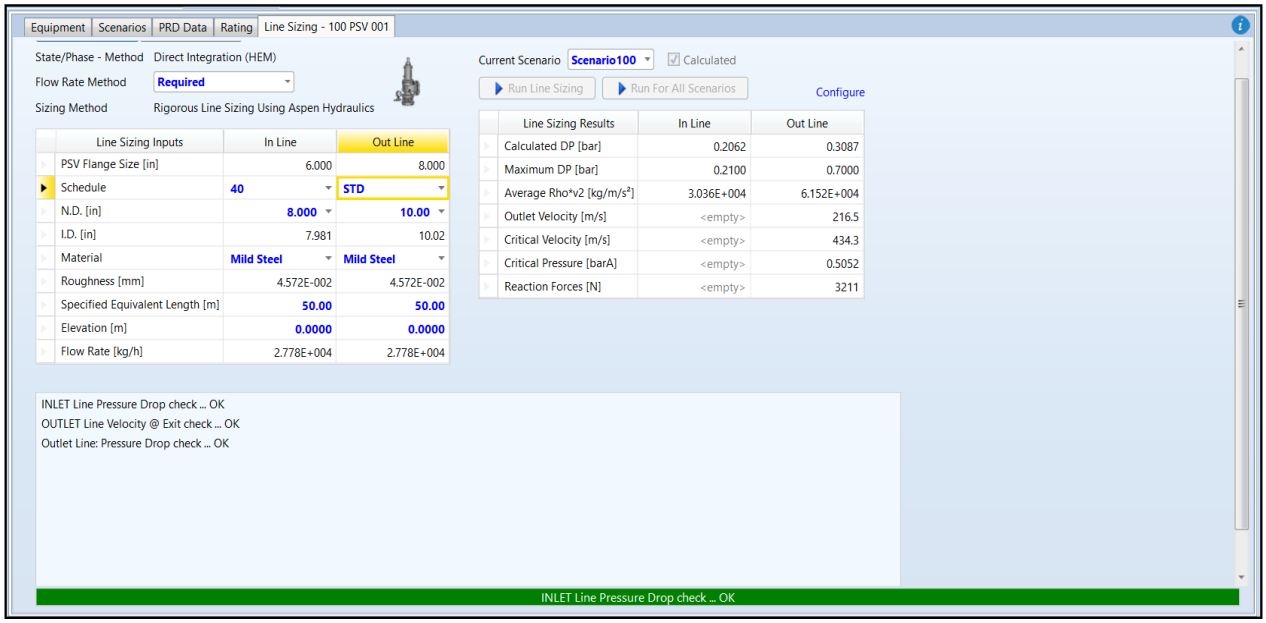
PSV Results	Value
Calculated Orifice [cm^2]	52.49
Selected Orifice [cm^2]	71.290 (Q)
Fraction of Full Lift	1.000
Rated Capacity [kg/h]	3.773E+004
Capacity Used [%]	73.62
Orifice Designation	6 Q 8
In/Out Flanges	150 x 150
Discharge Coefficient (Kd)	0.9750

Based on the calculation, the orifice designation should be 6Q8.

5.Now go to line sizing tab



Based on calculation, the pressure drop for both inlet and outlet has exceeded the criteria. In order to resolve the issue, let's select a line with bigger size for inlet and outlet.



The problem solved!

Here is the summary of what we have obtained.

Relief load	27780 kg/hr.
Scenario	Control Valve Failure
Calculation Method	PSV Plus
Selected Orifice	71.29-Q
Orifice Designation	6Q8
Inlet Line Size	8 inch
Outlet Line Size	10 inch