

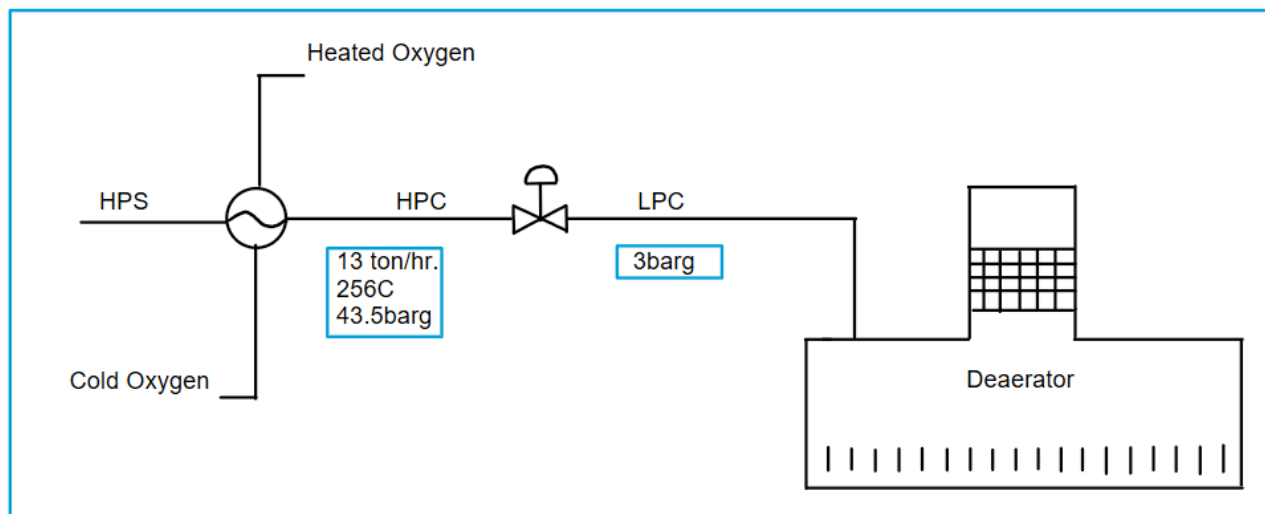


## Control Valve Simulation





Example 1: In order to perform optimization during basic design, a process designer decides to reuse HP condensate of a heat exchanger as the make-up of deaerator. Here is the PFD-like sketch:



Calculate the amount of liquid flashed at the outlet of the control valve.

The process designer at first does the calculation using manual way; then to verify and finalized his result, he uses Aspen Hysys. Here is his manual calculation:

$$M_1 H_1 = M_v H_v + M_l H_l$$
$$13000 \times 1114 = M \times 2723 + (13000 - M) \times 560.5$$
$$M = 3327.4 \text{ kg}$$
$$\text{Flashing} = 26\%$$



How to simulate:

1. Select water as the component in component list.

Source Databank: HYSYS

Select: **Pure Components** Filter: **All Families**

Search for: Search by: **Full Name/Synonym**

Component	Type	Group
H2O	Pure Component	

< Add Replace Remove

Simulation Name	Full Name / Synonym	Formula
Methane	C1	CH4
Ethane	C2	C2H6
Propane	C3	C3H8
i-Butane	i-C4	C4H10
n-Butane	n-C4	C4H10
i-Pentane	i-C5	C5H12
n-Pentane	n-C5	C5H12
n-Hexane	C6	C6H14
n-Heptane	C7	C7H16
n-Octane	C8	C8H18
n-Nonane	C9	C9H20
n-Decane	C10	C10H22

Status: OK

2. Select NBS Steam as Fluid Package.

Set Up | **StabTest** | Phase Order | Notes

Package Type: HYSYS Component List Selection: **Component List - 1 [HYSYS Databanks]** View

Property Package Selection

- CPA
- Esso Tabular
- Extended NRTL
- GCEOS
- General NRTL
- Glycol Package
- Grayson Streed
- IAPWS-IF97
- Kabadi-Danner
- Lee-Kesler-Plöcker
- MBWR
- NBS Steam**
- NRTL
- Peng-Robinson
- PR-Twu
- PRSV
- Sour PR
- Sour SRK

Property Pkg: OK Edit Properties



3. Enter Simulation Environment and define stream 1 with aforementioned condition:

Material Stream: 1

Worksheet Attachments Dynamics

**Worksheet**

- Conditions
- Properties
- Composition
- Oil & Gas Feed
- Petroleum Assay
- K Value
- User Variables
- Notes
- Cost Parameters
- Normalized Yields
- ▶ Emissions

Stream Name	1
Vapour / Phase Fraction	<empty>
Temperature [C]	256.0
Pressure [kPa]	4451
Molar Flow [kgmole/h]	<empty>
Mass Flow [kg/h]	1.300e+004
Std Ideal Liq Vol Flow [m3/h]	<empty>
Molar Enthalpy [kJ/kgmole]	<empty>
Molar Entropy [kJ/kgmole-C]	<empty>
Heat Flow [kJ/h]	<empty>
Liq Vol Flow @Std Cond [m3/h]	<empty>
Fluid Package	Basis-1
Utility Type	

Unknown Compositions

Delete Define from Stream... View Assay

Material Stream: 1

Worksheet Attachments Dynamics

**Worksheet**

- Conditions
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	Mole Fractions	Aqueous Phase
H2O	1.0000	1.0000

Total 1.00000

Edit... View Properties... Basis...

OK

Delete Define from Stream... View Assay



4. Select control valve from Model Palette/Pressure Change and put in the flowsheet. Then, connect stream 1 to the inlet and define stream 2 as the outlet. Set pressure drop to 40.5 bar.

Valve: VLV-100

Design Rating Worksheet Dynamics

**Design**

Connections  
Parameters  
User Variables  
Notes

Name: VLV-100

Inlet: 1

Outlet: 2

Fluid Package: Basis-1

Delete

Unknown Delta P

☐ Ignored

Valve: VLV-100

Design Rating Worksheet Dynamics

**Design**

Connections  
Parameters  
User Variables  
Notes

Delta P: 4050 kPa

☐ Use sizing methods to calculate Delta P

Delete

OK

☐ Ignored



5. Based on the result, the flashing is 24%.

Valve: VLV-100

Design Rating Worksheet Dynamics

**Worksheet**

Conditions Properties Composition PF Specs

Name	1	2
Vapour	0.0000	0.2387
Temperature [C]	256.0	143.8
Pressure [kPa]	4451	401.3
Molar Flow [kgmole/h]	721.6	721.6
Mass Flow [kg/h]	1.300e+004	1.300e+004
Std Ideal Liq Vol Flow [m3/h]	13.03	13.03
Molar Enthalpy [kJ/kgmole]	-2.668e+005	-2.668e+005
Molar Entropy [kJ/kgmole-C]	51.29	54.04
Heat Flow [kJ/h]	-1.925e+008	-1.925e+008

Delete OK Ignored

Valve: VLV-100

Design Rating Worksheet Dynamics

**Worksheet**

Conditions Properties Composition PF Specs

Name	1	2
Vapour	0.0000	0.2387
Temperature [C]	256.0	143.8
Pressure [kPa]	4451	401.3
Molar Flow [kgmole/h]	721.6	721.6
Mass Flow [kg/h]	1.300e+004	1.300e+004
Std Ideal Liq Vol Flow [m3/h]	13.03	13.03
Molar Enthalpy [kJ/kgmole]	-2.668e+005	-2.668e+005
Molar Entropy [kJ/kgmole-C]	51.29	54.04
Heat Flow [kJ/h]	-1.925e+008	-1.925e+008

Delete OK Ignored