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determination of distillation tower working pressure

Reza Modanloo

Senior Process Engineer /Open to new opportunities
Top Contributor

Dear all,
in designation of a distillation tower with HYSYS, we have to enter top and bottom working pressures of the tower in the first page. on the other word, without providing distillation tower working pressure, we can not run the program
does somebody know how we can determine the working pressure of a distillation column while we know that the only available data are as follow:

- Feed process conditions (flowrate, pressure, temperature and

composition)

- specification of overhead and bottom products

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Hooman

Hooman Tabaraei

Specialist Process Engineer (MIChemE, CEng)

Hi Reza,

Working pressure at top/bottom of distillation column depends on dew point/bubble point temperature of ovhd/bottom of distillation column. Working pressure of ovhd is close to inlet feed pressure (if pressure drop through trays assumed negligible), however bottom pressure is more than inlet feed pressure due to static head pressure. Nevertheless, following scenarios might be considered to determination of ovhd/bottom pressure of distillation column;

1) If you're dealing with heavy components at bottom of column, so you need to provide a significant duty for reboiler to vaporise heavy components. Hence, it's recommended to reduce the inlet feed pressure of the distillation column by installing a control valve at upstream of column, in order to have lower boiling point temperature and consequently lower duty of reboiler.

2) In case of reduction of inlet feed pressure, reboiler duty may reduce but dew point temperature of ovhd in condenser (top of distillation column) will be less too. For example, ovhd dew point temperature at 5 barg, assumed 60 degc, and new (corresponding) dew point temperature at ATM will be 20 degc. So it means you ONLY are allowed to provide condensation of ovhd in new case by cooling water as cold service, and air cooler is NOT applicable.

Hope it helps you in determination of working pressure.

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Reza

Reza Modanloo

Senior Process Engineer /Open to new opportunities
Top Contributor

Hi Hooman,

Thanks very much for your explanations.

after posting my question in the our group, i came up with a good text which explained about this issue. actually operating pressure of the distillation column depends on type of cooling medium that we use for condense the OVH vapor and providing the reflux. for instance if we use air cooler then the condensing temperature equals summer temperature plus 10 oC (we have to consider 10 degrees temperature approach). so we have the bubble point (summer temperature + 10) and also the overhead product composition and we can easily calculate the bubble point pressure (you can use hysys for that)

Regards

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Wilfredo

Wilfredo Garcia

Process Specialist at Ecopetrol

Dear Reza,

have a look to the papers I submitted to your email.

Cheers,

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javeria

javeria Javeriaiqbal95

Student at uet lahore

i have to design the distillation column for that i want to know how to select the operating pressure of distillation column, that would be constant throughout for design calculation? what should be the pressure of incoming feed or the pressure difference between column inlet pressure and feed pressure so that feed easily come in column...

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Reza

Reza Modanloo

Senior Process Engineer /Open to new opportunities

Top Contributor

dear javeria,

separation is generally easier at lower pressures.but you have to have colder medium available as coolant to condense overhead stream at lower pressure.so type of available coolant governs distillation column pressure.use following procedure to determine distillation column operating pressure:

1- determine available coolant in your site which might be cooling water,sea water or another refrigerant

2-deduct 5-10 degrees from coolant temperature to determine overhead condensation temperature.for instance if your available coolant is cooling water which its temperature is usually 25 degrees,then the temperature of tower over head equals 20 degrees.you consider 5 degrees as temperature approach.

3-now by having over head product composition and calculated temperature in step 2,you can easily determine the column overhead pressure in hysys.

hope this can help you.

good luck

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👍 [javeria J.](#) likes this



javeria

javeria Javeriaiqbal95

Student at uet lahore

thank you very much Mr. Reza modanloo.. i get your point.. is there any relevant data or research paper i can check for further detail and queries.. i would be very grateful to you.

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Reza

Reza Modanloo

Senior Process Engineer /Open to new opportunities

Top Contributor

no worries my friend,GPSA could be good reference.

good luck.by the way,do a good search in the internet to find related good manuals

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Tamer Saad

Tamer Saad Abdel Salam, M.Sc, MBA

Lead Optimization Engineer at QCLNG

you can run the column shortcut in HYSYS, as it is suitable for the design phase. it need from you minimum data like the key heavy component in top and key light component in bottom, changing the duty of the condenser and tower pressure (reflux ratio) will end up eventually to the optimum operating conditions

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vishal

vishal singh chauhan

GRADUATE ENGINEER TRAINEE at Reliance industries limited

As we know that if we go on increasing the pressure of a column the separation become difficult but still why we use high pressure in column say for example [separation of C2 and lighter from C3 streams in propylene recovery unit] (operated at 24.4 kg/cms)?

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Reza

Reza Modanloo

Senior Process Engineer /Open to new opportunities
Top Contributor

dear vishal.as u said,we'd better to run the column with lower pressure as much as we can but there should be required coolant (cooling water,chilled water,refrigerant,...) available.type of coolant that we have available is exactly the limitation we have for lower temp. at column overhead and as you know,temp. and pressure are equivalent with each other.
hope this can help

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vishal

vishal singh chauhan

GRADUATE ENGINEER TRAINEE at Reliance industries limited

thank you Reza sir.

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Shaun

Shaun Nateghi

Senior Process Engineer, CPEng MIEAust, RPEQ, NPER

Vishal,

In addition to the point Reza mentioned, higher pressure would favour design economy by reducing the tower diameter, though it could necessitate thicker wall. It is all about trade off among various parameters.

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Murali

Murali Muthu

Senior Process Engineer at Tebodin Middle East

Low pressure column:

For low pressure columns, back pressure determines the top pressure of the column i.e., purely hydraulics.If the column pressure is reduced, the vapour flow in the column is increased which would make you to manufacture a fatter column.

High pressure column:

The reason for having higher top pressure is to condense the top vapor either partially or fully by using condensor to have reflux and condensed product. For better understanding for the same separation top pressure can be decreased based on the utility used in the condensor in the order of air, water , chilled medium. By using chilled medium we can reduce the column pressure but not economical.

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Anup

Anup Paul Elias

Process Engineer

Column overhead pressure is determined based on the available cooling medium at the site to condense your overhead vapours (dew point of the distillate attainable at that temp)

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vishal

vishal singh chauhan

GRADUATE ENGINEER TRAINEE at Reliance industries limited

Thank you murali sir and Anup Paul sir

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