# CL312 ASSIGNMENT - 4

## GROUP -10

a)The actual Bottoms rates:

- **Bottom 1**: 99.59% Methane, 0.408% Acetone (Mole fraction)(189.5 Kmol/hr)(Reflux Ratio: 6)
- **Bottom 2**: 0.443% Methane, 99.557% Acetone (Mole fraction) (205 Kmol/hr)(Reflux Ratio: 5)

b)Diameter of distillation Columns:

- D1: 1.8288 meter
- D2: 1.3716 meter

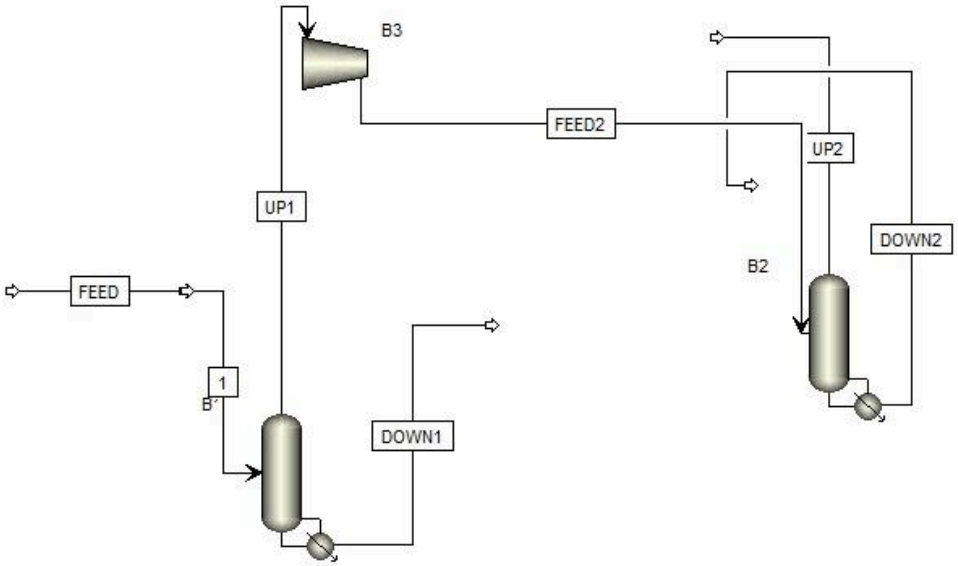
c)

- Minimum number of stages in column 1 that will minimize its reboiler duties: 40
- Minimum number of stages in column 2 that will minimize its reboiler duties: 40

d)

- Optimum feed stage locations that will minimize the reboiler duties column 1: 20
- Optimum feed stage locations that will minimize the reboiler duties column 2: 20

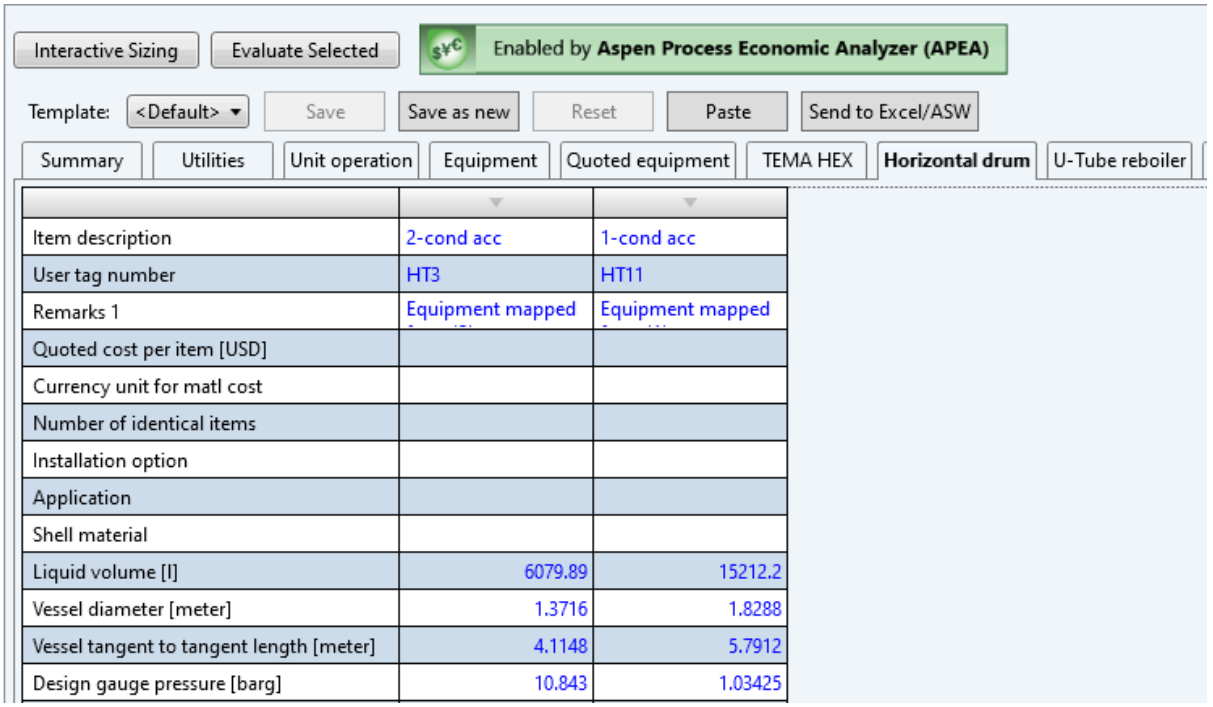
# FLOWSHEET



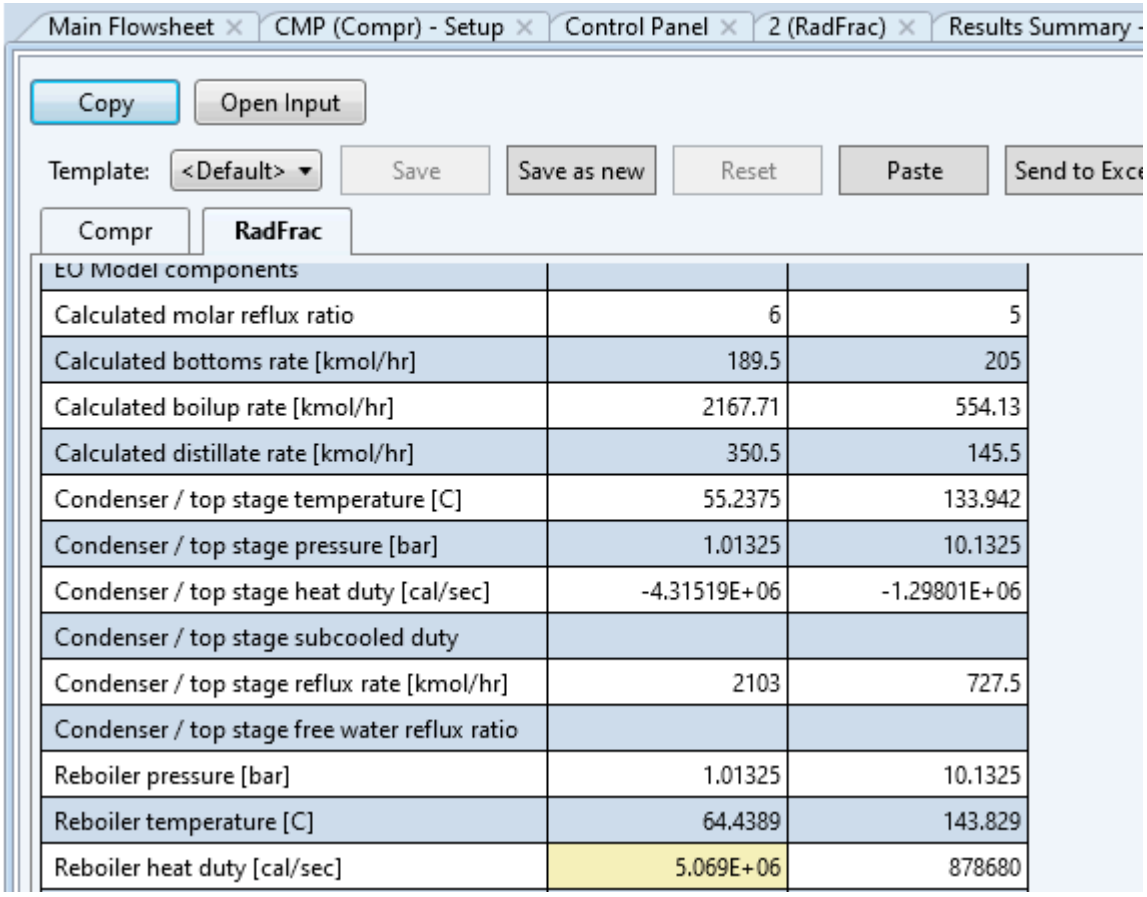

Main Flowsheet | CMP (Compr) - Setup | Control Panel | 2 (RadFrac) | 1 (RadFrac) | Results Summary - Run Status | 2 (RadFrac) - Results | **Results Summary - Streams (All)**

Material | Heat | Load | Work | Power | Vol.% Curves | Wt. % Curves | Petroleum | Polymers | Solids

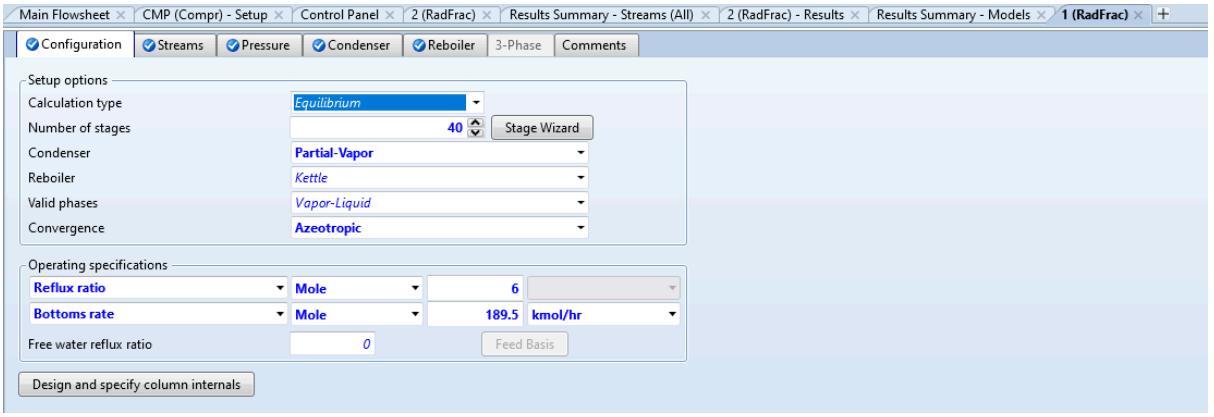
| | Units | B1 | B2 | FEED | T1HP | T1LP | T2 |
|---|---|---|---|---|---|---|---|
| Mass Liquid Fraction | | 1 | 1 | 1 | 0 | 0 | 0 |
| Mass Solid Fraction | | 0 | 0 | 0 | 0 | 0 | 0 |
| Molar Enthalpy | cal/mol | -56206 | -55325.7 | -57417.2 | -48151.4 | -50328.8 | -48422.9 |
| Mass Enthalpy | cal/gm | -1748.32 | -954.298 | -1274.21 | -925.236 | -967.074 | -1108.5 |
| Molar Entropy | cal/mol-K | -55.0881 | -63.8144 | -62.9809 | -43.0332 | -44.4231 | -39.5991 |
| Mass Entropy | cal/gm-K | -1.71355 | -1.10072 | -1.39768 | -0.826888 | -0.853595 | -0.906505 |
| Molar Density | mol/cc | 0.0231493 | 0.0107831 | 0.0170267 | 0.000307109 | 3.89092e-05 | 0.00035353 |
| Mass Density | gm/cc | 0.744218 | 0.625153 | 0.767241 | 0.0159827 | 0.00202492 | 0.0154434 |
| Enthalpy Flow | cal/sec | -2.95862e+06 | -3.15049e+06 | -8.61258e+06 | -4.68808e+06 | -4.90007e+06 | -1.95709e+06 |
| Average MW | | 32.1486 | 57.9753 | 45.0611 | 52.0423 | 52.0423 | 43.6832 |
| **+ Mole Flows** | **kmol/hr** | **189.5** | **205** | **540** | **350.5** | **350.5** | **145.5** |
| **− Mole Fractions** | | | | | | | |
| ACETO-01 | | 0.00408656 | 0.995976 | 0.5 | 0.768119 | 0.768119 | 0.447082 |
| METHA-01 | | 0.995913 | 0.00402392 | 0.5 | 0.231881 | 0.231881 | 0.552918 |

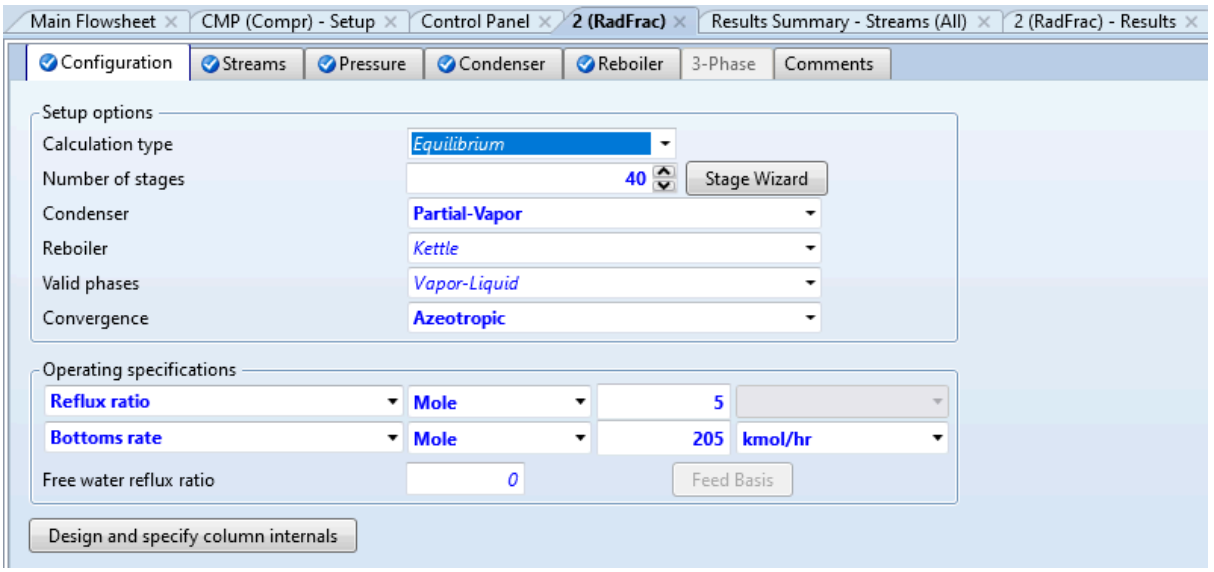


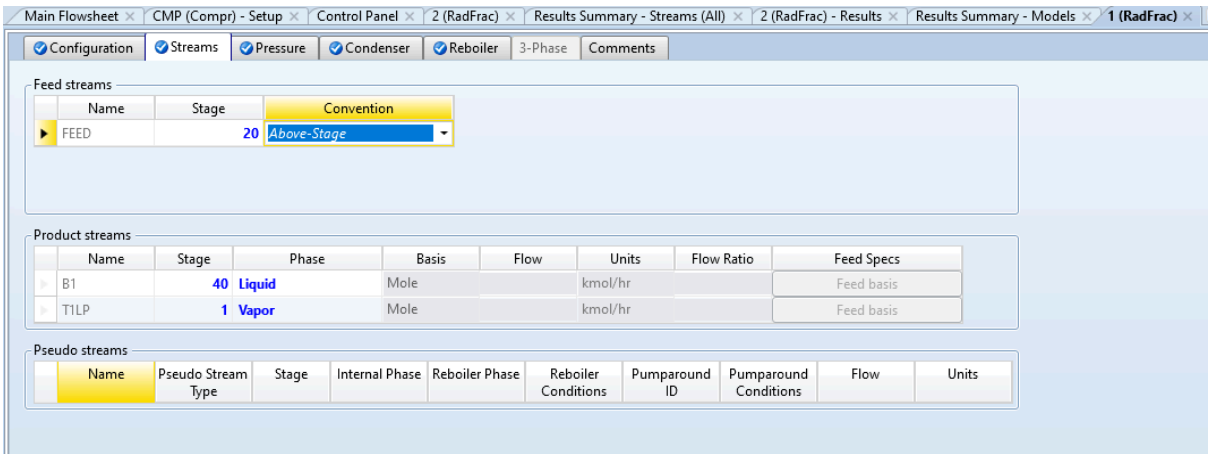

| | | |
|---|---|---|
| Item description | 2-cond acc | 1-cond acc |
| User tag number | HT3 | HT11 |
| Remarks 1 | Equipment mapped | Equipment mapped |
| Quoted cost per item [USD] | | |
| Currency unit for matl cost | | |
| Number of identical items | | |
| Installation option | | |
| Application | | |
| Shell material | | |
| Liquid volume [l] | 6079.89 | 15212.2 |
| Vessel diameter [meter] | 1.3716 | 1.8288 |
| Vessel tangent to tangent length [meter] | 4.1148 | 5.7912 |
| Design gauge pressure [barg] | 10.843 | 1.03425 |

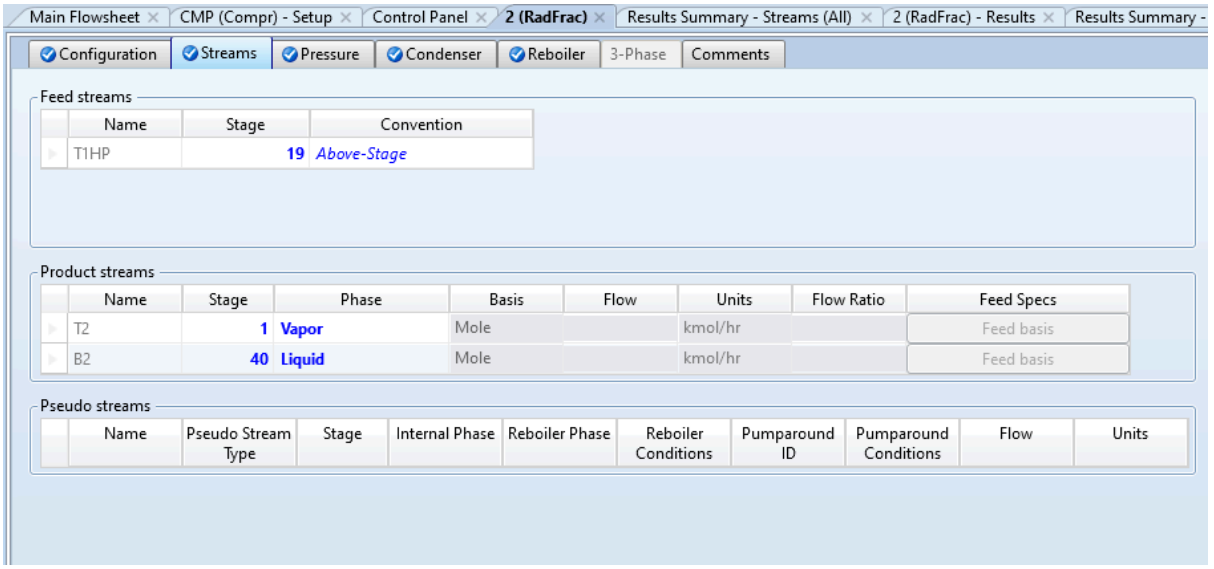



| EO Model components | | |
|---|---|---|
| Calculated molar reflux ratio | 6 | 5 |
| Calculated bottoms rate [kmol/hr] | 189.5 | 205 |
| Calculated boilup rate [kmol/hr] | 2167.71 | 554.13 |
| Calculated distillate rate [kmol/hr] | 350.5 | 145.5 |
| Condenser / top stage temperature [C] | 55.2375 | 133.942 |
| Condenser / top stage pressure [bar] | 1.01325 | 10.1325 |
| Condenser / top stage heat duty [cal/sec] | -4.31519E+06 | -1.29801E+06 |
| Condenser / top stage subcooled duty | | |
| Condenser / top stage reflux rate [kmol/hr] | 2103 | 727.5 |
| Condenser / top stage free water reflux ratio | | |
| Reboiler pressure [bar] | 1.01325 | 10.1325 |
| Reboiler temperature [C] | 64.4389 | 143.829 |
| Reboiler heat duty [cal/sec] | 5.069E+06 | 878680 |


Main Flowsheet
CMP (Compr) - Setup
Control Panel
2 (RadFrac)
Results Summary - Streams (All)
2 (RadFrac) - Results
Results Summary - Models
1 (RadFrac)
Configuration
Streams
Pressure
Condenser
Reboiler
3-Phase
Comments
Setup options
Calculation type
Equilibrium
Number of stages
40
Stage Wizard
Condenser
Partial-Vapor
Reboiler
Kettle
Valid phases
Vapor-Liquid
Convergence
Azeotropic
Operating specifications
Reflux ratio
Mole
6
Bottoms rate
Mole
189.5
kmol/hr
Free water reflux ratio
0
Feed Basis
Design and specify column internals


Main Flowsheet
CMP (Compr) - Setup
Control Panel
2 (RadFrac)
Results Summary - Streams (All)
2 (RadFrac) - Results
Configuration
Streams
Pressure
Condenser
Reboiler
3-Phase
Comments
Setup options
Calculation type
Equilibrium
Number of stages
40
Stage Wizard
Condenser
Partial-Vapor
Reboiler
Kettle
Valid phases
Vapor-Liquid
Convergence
Azeotropic
Operating specifications
Reflux ratio
Mole
5
Bottoms rate
Mole
205
kmol/hr
Free water reflux ratio
0
Feed Basis
Design and specify column internals


Main Flowsheet
CMP (Compr) - Setup
Control Panel
2 (RadFrac)
Results Summary - Streams (All)
2 (RadFrac) - Results
Results Summary - Models
1 (RadFrac)
Configuration
Streams
Pressure
Condenser
Reboiler
3-Phase
Comments
Feed streams
Name
Stage
Convention
FEED
20
Above-Stage
Product streams
Name
Stage
Phase
Basis
Flow
Units
Flow Ratio
Feed Specs
B1
40
Liquid
Mole
kmol/hr
Feed basis
T1LP
1
Vapor
Mole
kmol/hr
Feed basis
Pseudo streams
Name
Pseudo Stream Type
Stage
Internal Phase
Reboiler Phase
Reboiler Conditions
Pumparound ID
Pumparound Conditions
Flow
Units


Main Flowsheet
CMP (Compr) - Setup
Control Panel
2 (RadFrac)
Results Summary - Streams (All)
2 (RadFrac) - Results
Results Summary -
Configuration
Streams
Pressure
Condenser
Reboiler
3-Phase
Comments
Feed streams
Name
Stage
Convention
T1HP
19
Above-Stage
Product streams
Name
Stage
Phase
Basis
Flow
Units
Flow Ratio
Feed Specs
T2
1
Vapor
Mole
kmol/hr
Feed basis
B2
40
Liquid
Mole
kmol/hr
Feed basis
Pseudo streams
Name
Pseudo Stream Type
Stage
Internal Phase
Reboiler Phase
Reboiler Conditions
Pumparound ID
Pumparound Conditions
Flow
Units