CL312 ASSIGNMENT - 3
GROUP -04

a) HEIGHT OF THE COLUMN = 8.5344 m
DIAMETER OF THE COLUMN = 2.7432 m

Item description	RADFRAC-cond acc
User tag number	HT3
Remarks 1	Equipment mapped
Quoted cost per item [USD]	
Currency unit for matl cost	
Number of identical items	
Installation option	
Application	
Shell material	
Liquid volume [l]	50440.6
Vessel diameter [meter]	2.7432
Vessel tangent to tangent length [meter]	8.5344
Design gauge pressure [barg]	17.7331
Vacuum design gauge pressure [barg]	
Design temperature [C]	121.111
Operating temperature [C]	55.7745
Cladding material	
Diameter of drip leg [meter]	
Length of drip leg [meter]	
Base material thickness [meter]	
Corrosion allowance [meter]	

b)

FEED STAGE LOCATION	REFLUX RATIO	CONDENSER DUTY(cal/sec)	REBOILER DUTY(cal/sec)
12	2	-3782570	4742810
13	2	-3782370	4742750
14	2	-3782290	4742710
15	2	-3782550	4742840
16	2	-3783320	4743220
17	2	-3784040	4743610
18	2	-3785170	4744170

For:

- FEED STAGE LOCATION = 12

Top stage pressure [atm]	16.8
Specified reflux ratio	2
Specified bottoms rate [kmol/hr]	
Specified boilup rate [kmol/hr]	
Specified distillate rate [kmol/sec]	0.4
EO Model components	
Calculated molar reflux ratio	2
Calculated bottoms rate [kmol/hr]	2160
Calculated boilup rate [kmol/hr]	5242.23
Calculated distillate rate [kmol/hr]	1440
Condenser / top stage temperature [C]	55.7593
Condenser / top stage pressure [bar]	17.0226
Condenser / top stage heat duty [cal/sec]	-3.78257E+06
Condenser / top stage subcooled duty	
Condenser / top stage reflux rate [kmol/hr]	2880
Condenser / top stage free water reflux ratio	
Reboiler pressure [bar]	17.2362
Reboiler temperature [C]	87.3481
Reboiler heat duty [cal/sec]	4.74281E+06
Total feed stream CO2e flow [kg/hr]	1269.98
Total product stream CO2e flow [kg/hr]	1269.98
Net stream CO2e production [kg/hr]	0

- FEED STAGE LOCATION = 13

Top stage pressure [atm]	16.8
Specified reflux ratio	2
Specified bottoms rate [kmol/hr]	
Specified boilup rate [kmol/hr]	
Specified distillate rate [kmol/sec]	0.4
EO Model components	
Calculated molar reflux ratio	2
Calculated bottoms rate [kmol/hr]	2160
Calculated boilup rate [kmol/hr]	5242.4
Calculated distillate rate [kmol/hr]	1440
Condenser / top stage temperature [C]	55.7452
Condenser / top stage pressure [bar]	17.0226
Condenser / top stage heat duty [cal/sec]	-3.78237E+06
Condenser / top stage subcooled duty	
Condenser / top stage reflux rate [kmol/hr]	2880
Condenser / top stage free water reflux ratio	
Reboiler pressure [bar]	17.2362
Reboiler temperature [C]	87.361
Reboiler heat duty [cal/sec]	4.74275E+06
Total feed stream CO2e flow [kg/hr]	1269.98
Total product stream CO2e flow [kg/hr]	1269.98
Net stream CO2e production [kg/hr]	8.63901E-07

- FEED STAGE LOCATION = 14

RadFrac

Top stage pressure [atm]	16.8
Specified reflux ratio	2
Specified bottoms rate [kmol/hr]	
Specified boilup rate [kmol/hr]	
Specified distillate rate [kmol/sec]	0.4
EO Model components	
Calculated molar reflux ratio	2
Calculated bottoms rate [kmol/hr]	2160
Calculated boilup rate [kmol/hr]	5242.4
Calculated distillate rate [kmol/hr]	1440
Condenser / top stage temperature [C]	55.7423
Condenser / top stage pressure [bar]	17.0226
Condenser / top stage heat duty [cal/sec]	-3.78229E+06
Condenser / top stage subcooled duty	
Condenser / top stage reflux rate [kmol/hr]	2880
Condenser / top stage free water reflux ratio	
Reboiler pressure [bar]	17.2362
Reboiler temperature [C]	87.3637
Reboiler heat duty [cal/sec]	4.74271E+06
Total feed stream CO2e flow [kg/hr]	1269.98
Total product stream CO2e flow [kg/hr]	1269.98
Net stream CO2e production [kg/hr]	0
Utility CO2e production [kg/hr]	0

- FEED STAGE LOCATION = 15

RadFrac

Top stage pressure [atm]	16.8
Specified reflux ratio	2
Specified bottoms rate [kmol/hr]	
Specified boilup rate [kmol/hr]	
Specified distillate rate [kmol/sec]	0.4
EO Model components	
Calculated molar reflux ratio	2
Calculated bottoms rate [kmol/hr]	2160
Calculated boilup rate [kmol/hr]	5242.39
Calculated distillate rate [kmol/hr]	1440
Condenser / top stage temperature [C]	55.7526
Condenser / top stage pressure [bar]	17.0226
Condenser / top stage heat duty [cal/sec]	-3.78255E+06
Condenser / top stage subcooled duty	
Condenser / top stage reflux rate [kmol/hr]	2880
Condenser / top stage free water reflux ratio	
Reboiler pressure [bar]	17.2362
Reboiler temperature [C]	87.3542
Reboiler heat duty [cal/sec]	4.74284E+06
Total feed stream CO2e flow [kg/hr]	1269.98
Total product stream CO2e flow [kg/hr]	1269.98
Net stream CO2e production [kg/hr]	-3.03498E-07
Utility CO2e production [kg/hr]	0

- FEED STAGE LOCATION = 16

EO Model components	
Calculated molar reflux ratio	2
Calculated bottoms rate [kmol/hr]	2160
Calculated boilup rate [kmol/hr]	5242.34
Calculated distillate rate [kmol/hr]	1440
Condenser / top stage temperature [C]	55.7745
Condenser / top stage pressure [bar]	17.0226
Condenser / top stage heat duty [cal/sec]	-3.78332E+06
Condenser / top stage subcooled duty	
Condenser / top stage reflux rate [kmol/hr]	2880
Condenser / top stage free water reflux ratio	
Reboiler pressure [bar]	17.2362
Reboiler temperature [C]	87.334
Reboiler heat duty [cal/sec]	4.74322E+06
Total feed stream CO2e flow [kg/hr]	1269.98
Total product stream CO2e flow [kg/hr]	1269.98
Net stream CO2e production [kg/hr]	1.2965E-06
Utility CO2e production [kg/hr]	0
Total CO2e production [kg/hr]	1.2965E-06
Condenser utility usage	
Condenser utility cost	
Condenser utility ID	
Reboiler utility usage	

- FEED STAGE LOCATION = 17

RadFrac

Top stage pressure [atm]	16.8
Specified reflux ratio	2
Specified bottoms rate [kmol/hr]	
Specified boilup rate [kmol/hr]	
Specified distillate rate [kmol/sec]	0.4
EO Model components	
Calculated molar reflux ratio	2
Calculated bottoms rate [kmol/hr]	2160
Calculated boilup rate [kmol/hr]	5242.28
Calculated distillate rate [kmol/hr]	1440
Condenser / top stage temperature [C]	55.8106
Condenser / top stage pressure [bar]	17.0226
Condenser / top stage heat duty [cal/sec]	-3.78404E+06
Condenser / top stage subcooled duty	
Condenser / top stage reflux rate [kmol/hr]	2880
Condenser / top stage free water reflux ratio	
Reboiler pressure [bar]	17.2362
Reboiler temperature [C]	87.3008
Reboiler heat duty [cal/sec]	4.74361E+06
Total feed stream CO2e flow [kg/hr]	1269.98
Total product stream CO2e flow [kg/hr]	1269.98
Net stream CO2e production [kg/hr]	0
Utility CO2e production [kg/hr]	0

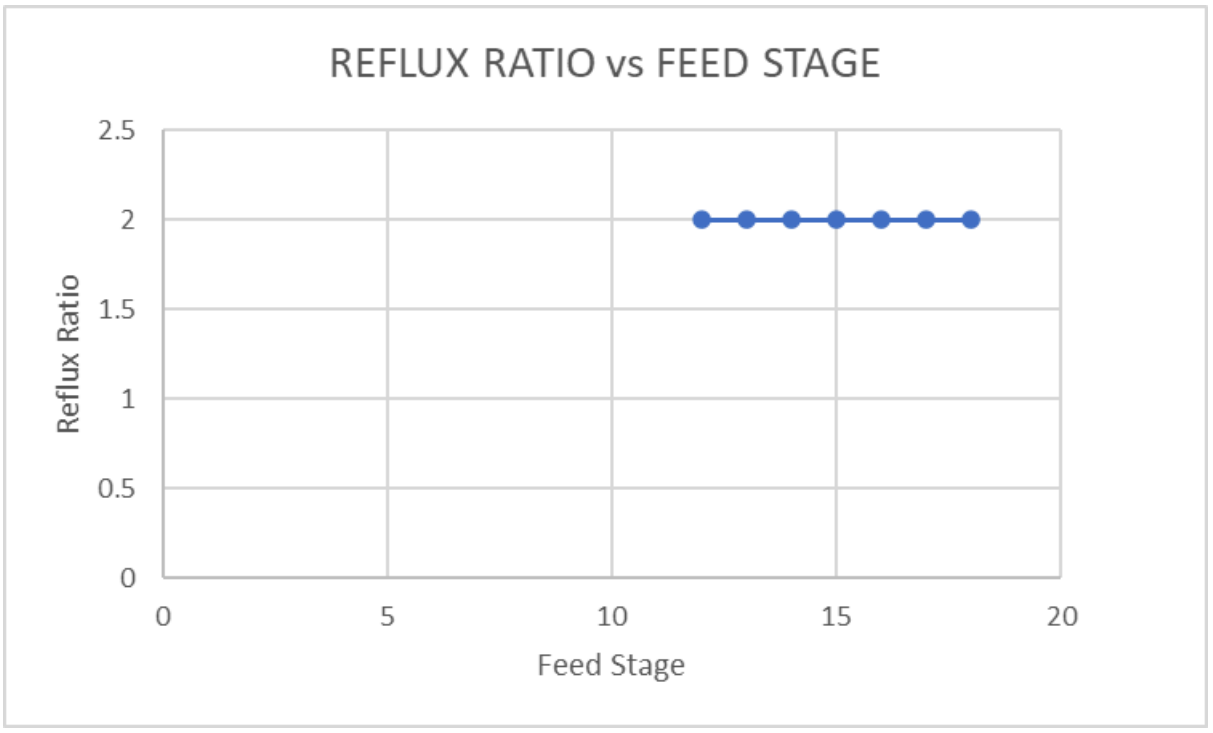
- FEED STAGE LOCATION = 18

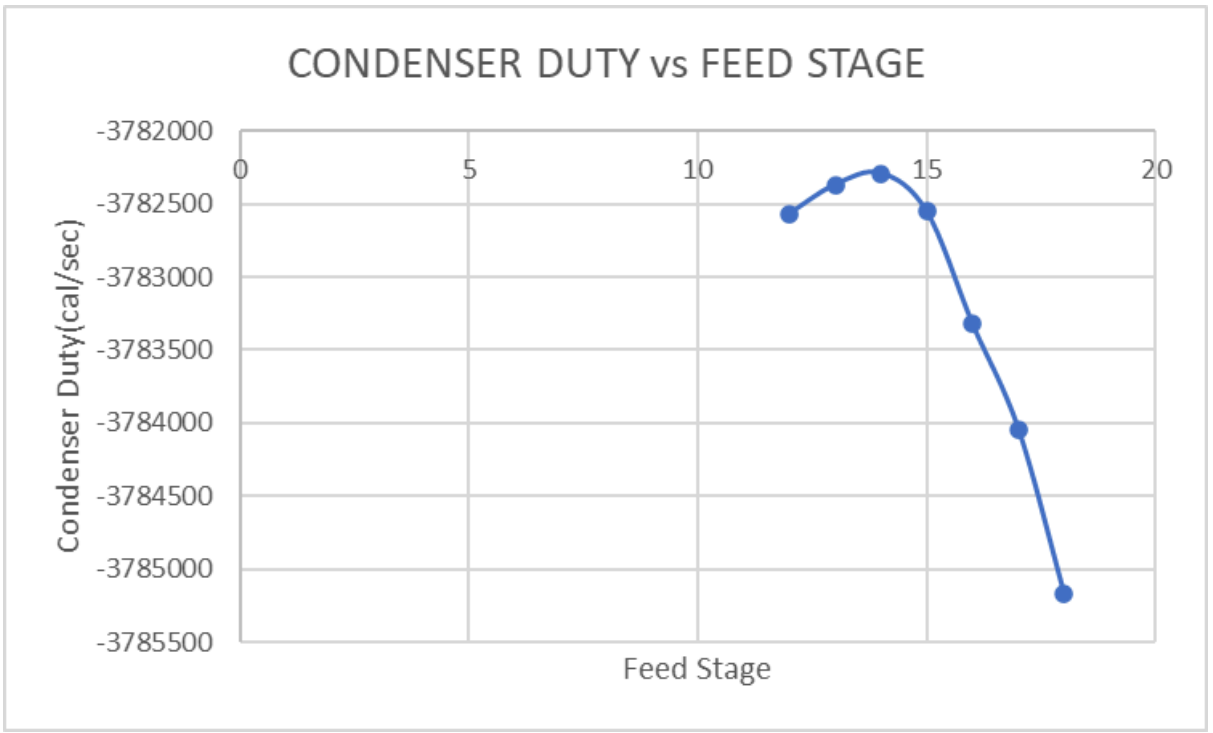
RadFrac

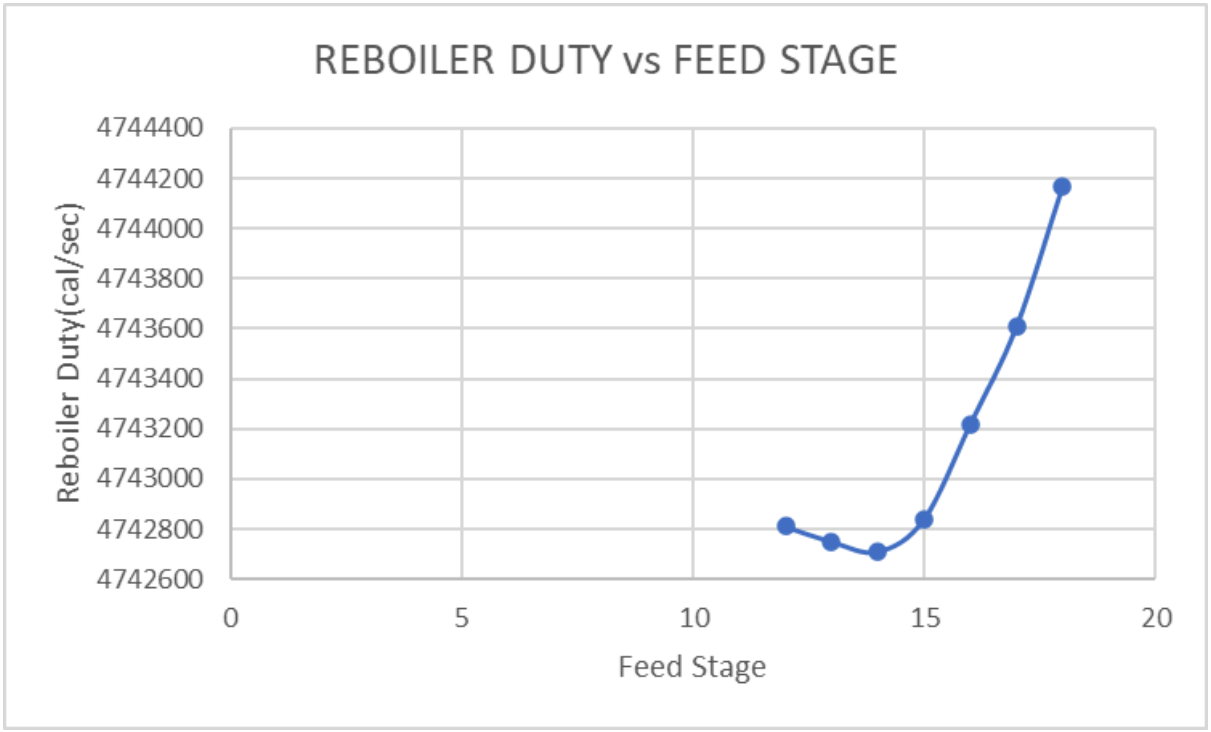
Top stage pressure [atm]	16.8
Specified reflux ratio	2
Specified bottoms rate [kmol/hr]	
Specified boilup rate [kmol/hr]	
Specified distillate rate [kmol/sec]	0.4
EO Model components	
Calculated molar reflux ratio	2
Calculated bottoms rate [kmol/hr]	2160
Calculated boilup rate [kmol/hr]	5242.09
Calculated distillate rate [kmol/hr]	1440
Condenser / top stage temperature [C]	55.8597
Condenser / top stage pressure [bar]	17.0226
Condenser / top stage heat duty [cal/sec]	-3.78517E+06
Condenser / top stage subcooled duty	
Condenser / top stage reflux rate [kmol/hr]	2880
Condenser / top stage free water reflux ratio	
Reboiler pressure [bar]	17.2362
Reboiler temperature [C]	87.2555
Reboiler heat duty [cal/sec]	4.74417E+06
Total feed stream CO2e flow [kg/hr]	1269.98
Total product stream CO2e flow [kg/hr]	1269.98
Net stream CO2e production [kg/hr]	8.03618E-06
Utility CO2e production [kg/hr]	0

c) **As concluded from the above table, the minimum condenser duty and reboiler duty with reflux ratio occurs at feed stage location 14**.

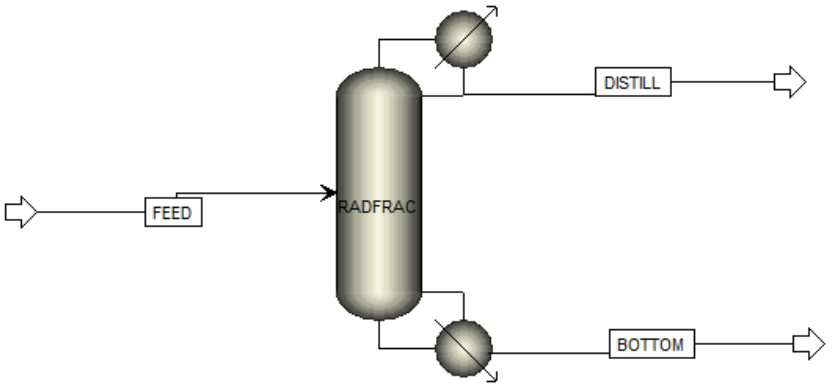
d)


REFLUX RATIO vs FEED STAGE
Reflux Ratio
2.5
2
1.5
1
0.5
0
0
5
10
15
20
Feed Stage


CONDENSER DUTY vs FEED STAGE
Condenser Duty(cal/sec)
-3782000
-3782500
-3783000
-3783500
-3784000
-3784500
-3785000
-3785500
0
5
10
15
20
Feed Stage


REBOILER DUTY vs FEED STAGE
Reboiler Duty(cal/sec)
4744400
4744200
4744000
4743800
4743600
4743400
4743200
4743000
4742800
4742600
0
5
10
15
20
Feed Stage

e) FLOWSHEET


DISTILL
FEED
RADFRAC
BOTTOM