

CAPCOST Illustration

TBWS, Chapter 5, Problem 4

The light gas separations unit of a certain refinery consists of **two columns in series** that are fed a mixture of propane, butanes, and higher hydrocarbons.

The first column, the depropanizer, separates the propane (and small amounts of propylene) from the heavier material.

The second column, the debutanizer, separates the butanes from the remaining hydrocarbons.

A PFD and equipment summary table are given in Figure P5 and Table P5.4, respectively.

Using the CAPCOST program, estimate the **total module cost** and **grass roots cost** of this process unit.

Why are we doing this example?

This particular problem features many elements common to capital cost estimation.

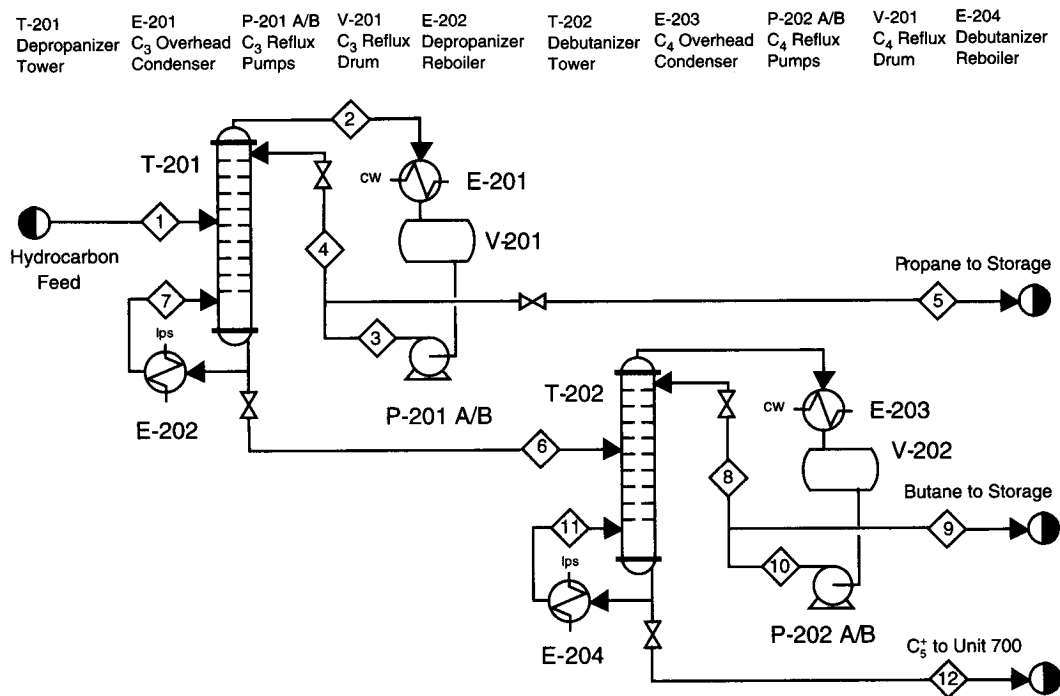


Figure P5.4 PFD for Unit 200—Light Gas Separations Plant

Table P5.4 Equipment Summaries for Problem 4

Equipment	E-201	E-202	E-203	E-204	T-201	T-202	P-201A/B	P-202A/B	V-201	V-202
Type	Floating head	Floating head	Floating head	Floating head	Tower	Tower	Centrifugal pump	Centrifugal pump	Horizontal vessel	Horizontal vessel
Area	155 m ²	45 m ²	85 m ²	20 m ²	-	-	-	-	-	-
Shell pressure*	15 barg	4 barg	5 barg	4 barg	-	-	-	-	-	-
Tube pressure*	4 barg	15 barg	4 barg	5 barg	-	-	-	-	-	-
MOC	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel	Carbon steel
Diameter	-	-	-	-	0.95 m	1.00 m	-	-	1.25 m	1.25 m
Length or height	-	-	-	-	19.0 m	21.0 m	-	-	3.75 m	3.75 m
Design pressure*	-	-	-	-	15 barg	5 barg	-	-	15 barg	5 barg
Internals	-	-	-	-	36 sieve trays	40 sieve trays	-	-	-	-
MOC	-	-	-	-	Stainless steel	Stainless steel	-	-	-	-
Power	-	-	-	-	-	-	1.3 kW	1.2 kW	-	-
Discharge pressure*	-	-	-	-	-	-	16 barg	6 barg	-	-

*all pressures are entered as bar gauge, 0.0 barg = 1.0 bar.

TBWS Problem 5.4 - Summary

Total Module Cost = \$821,000
 Grass Roots Cost = \$1,110,000

User Added Equipment

Compressors	Compressor Type	Power (kilowatts)	# Spares	MOC	Purchased Equipment Cost	Bare Module Cost
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Drives	Drive Type	Power (kilowatts)	# Spares	Purchased Equipment Cost	Bare Module Cost
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Evaporators	Type	Area (square meters)	Pressure (barg)	MOC	Volume (cubic meters)	Purchased Equipment Cost	Bare Module Cost
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Exchangers	Type of Exchanger	Shell Pressure (barg)	Tube Pressure (barg)	MOC	Area (square meters)	Purchased Equipment Cost	Bare Module Cost
E-201	Floating Head	15	4	Carbon Steel / Carbon Steel	155	\$ 31,300	\$ 105,000
E-202	Floating Head	4	15	Carbon Steel / Carbon Steel	45	\$ 19,700	\$ 65,500
E-203	Floating Head	5	4	Carbon Steel / Carbon Steel	85	\$ 23,700	\$ 78,100
E-204	Floating Head	5	4	Carbon Steel / Carbon Steel	20	\$ 18,300	\$ 60,300

Fans / Blowers	Type	Gas Flowrate (cubic meters/s)	# Spares	MOC	Pressure Rise Across Fan (barg)	Purchased Equipment Cost	Bare Module Cost
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Fired Heaters	Type	Heat Duty (MJ/h)	Steam Superheat (°C)	MOC	Pressure (barg)	Purchased Equipment Cost	Bare Module Cost
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Pumps (with drives)	Pump Type	Power (kilowatts)	# Spares	MOC	Discharge Pressure (barg)	Purchased Equipment Cost	Bare Module Cost
P-201	Centrifugal	1.3	1	Carbon Steel	16	\$ 4,990	\$ 22,000
P-202	Centrifugal	1.2	1	Carbon Steel	6	\$ 4,960	\$ 19,800

Storage Tanks	Tank Type	Volume (cubic meters)	Volume (gallons)	Purchased Equipment Cost	Bare Module Cost
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Towers	Tower Description	Height (meters)	Diameter (meters)	Tower MOC	Demister MOC	Pressure (barg)	Purchased Equipment Cost	Bare Module Cost
T-201	36 Stainless Steel Sieve Trays	19	0.95	Carbon Steel		15	\$ 45,000	\$ 137,000
T-202	40 Stainless Steel Sieve Trays	21	1.1	Carbon Steel		5	\$ 56,900	\$ 149,000

Turbines	Type of Turbine	Power (kilowatts)	# Spares	MOC	Purchased Equipment Cost	Bare Module Cost
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Vessels	Orientation	Length/Height (meters)	Diameter (meters)	MOC	Demister MOC	Pressure (barg)	Purchased Equipment Cost	Bare Module Cost
V-201	Horizontal	3.75	1.25	Carbon Steel		15	\$ 7,020	\$ 36,000
V-202	Horizontal	3.75	1.25	Carbon Steel		5	\$ 7,020	\$ 23,300

Sum Bare Module Cost \$ 696,000