CHAPTER III
PROCEDURES

3.1 Modeling Column and Process

3.1.1 Shortcut Distillation Design

Shortcut distillation method was selected as a design method for reaching the desired product quality which is specified in Table 3.1 and the specification of the columns was matched with the data specification. The design parameters, which have to be calculated, are tray efficiency, condenser duties and reboiler duties. The PRO/II will also determine the enthalpy of liquid and vapor in the column, flow rate of liquid and vapor in the column and condenser/reboiler duties. The actual case specification is based on the operating condition that shown in the Table 3.2.

The pressure drop in the column was designed, based on the design case data. The thermodynamic model is the Soave-Redlich-Kwong (SRK) equation suitable for hydrocarbon components.

3.1.2 Process Design

Process was designed to integrate with other unit operation such as shell and tube exchangers, LNG exchanger, flash drum and compressor with expander. This aim reaches the desired product and temperature.

3.2 Application of Pinch technology for Column Analysis.

3.2.1 Column Grand Composite Curve

The Calculation method was based on Practical Near Minimum Thermodynamic Condition (PNMTC). The method applied for this case was Top down method and Feed Stage Correction (FSC) method. From the graph that was generated, the sharp of CGCC curve is checked if a pinch-point is shown or not. The CGCC are based on both design case and actual case.

3.2.2 Column Modification Method

From the generated graph, if it did not have pinch point, it needed the column modification using the following method:

1). Change the reflux ratio

2). Change feed location

3). Installation of side condenser/reboiler

4). Installation of feed pre-heater

3.3 Heat Exchanger Network

The Heat Exchanger Network (HEN) was designed as an algorithm shown in Figure 3.1. The design parameters, which have to be calculated , are the minimum number of heat exchanger, the minimum energy requirement, estimation of minimum energy cost and estimation of HEN capital cost.

Table 3.1 Product stream composition and flow rate of the design data

Component (mole fraction)	Methane Product	Ethane Product	Propane Product	LPG Product
N_2	0.019571	0.00000	0.00000	0.00000
CH_4	0.957228	0.018925	0.00000	0.00000
C_2H_6	0.018521	0.931425	0.001898	0.000200
C_3H_8	0.000214	0.014997	0.995102	0.362371
i-C_4H_{10}	0.000002	0.000001	0.002967	0.336279
n-C_4H_{10}	0.00000	0.00000	0.000033	0.295796
i-C_5H_{12}	0.00000	0.00000	0.00000	0.004565
n-C_5H_{12}	0.00000	0.00000	0.00000	0.000789
n-C_6H_{14}	0.00000	0.00000	0.00000	0.00000
C 7 plus	0.00000	0.00000	0.00000	0.00000
CO_2	0.004463	0.034644	0.00000	0.00000
Flow rate (Mol/sec)	3395.16	402.68	172.76	158.14
Temperature (K)	171.59	273.30	300.00	349.71
Pressure (Bar G)	15.00	27.70	20.60	16.50

Table 3.2 Condition specification for actual case.

Column	Specification			
	Top Column Temperature (°C)	Bottom Column Temperature (°C)	Bottom pressure (ΔP drop) (BarG)	Bottom Product Flowrate (kg/hr)
Demethanizer Column	-97.6	2.76	15.41 (0.079)	104413.95
Deethanizer Column	6.19	98.5	26.89 (0.1)	N/A
Depropanizer Column	45.3	162.5	15.12 (0.1)	N/A

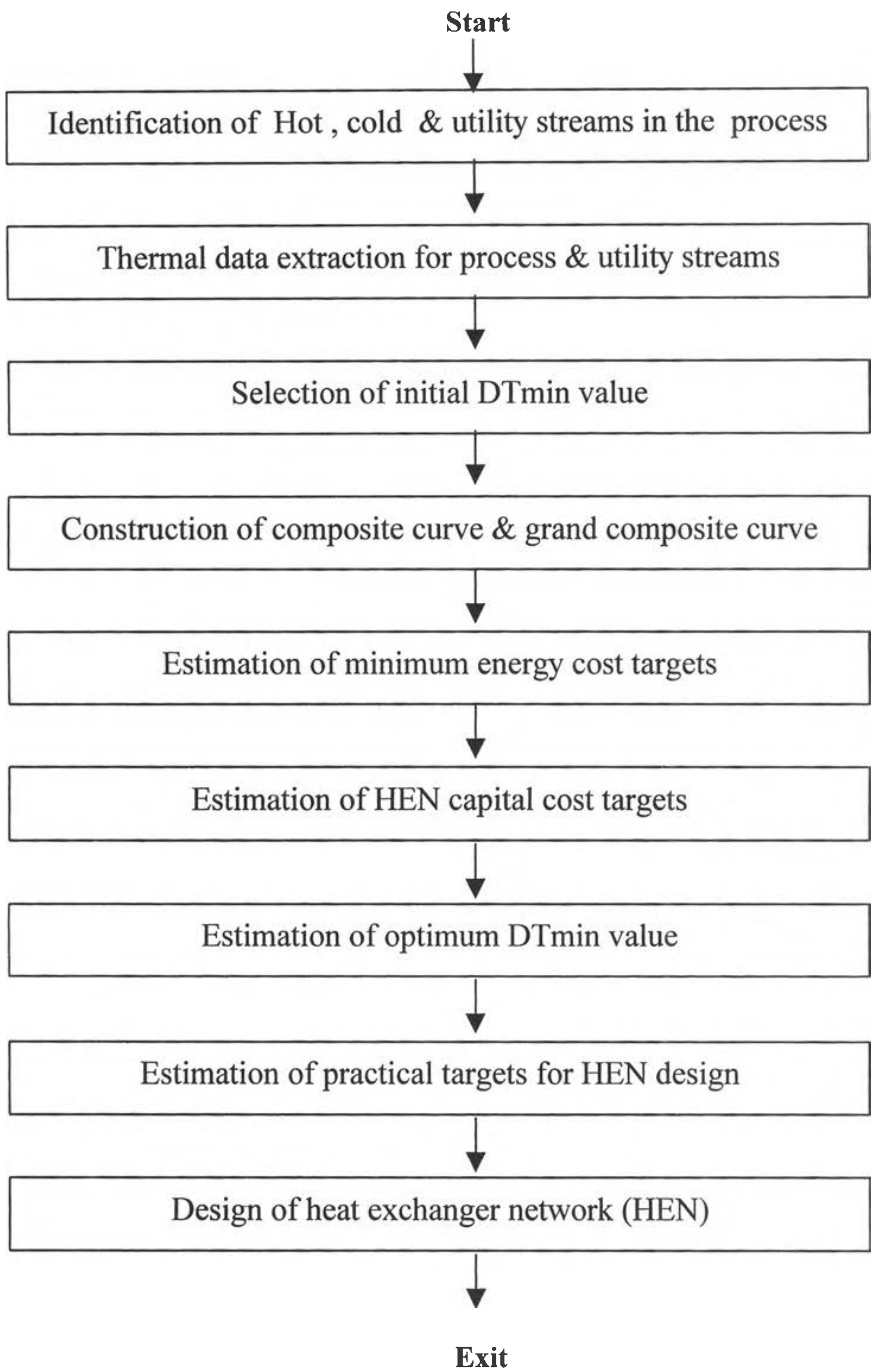

Figure 3.1 Algorithm for design Heat Exchanger Networks (HEN)