

## APPENDIX F

Output of the THEN program

### HEAT EXCHANGER NETWORK SYNTHESIS

#### DETAILS OF HOT STREAMS

```
=====
=====
ST NAME  FLOWRATE  MCP  INLET T  OUTLET T  FILM COEFFICIENT
=====
=====
```

C306	4.9	14.3	349.4	328.4	.1
C308	3.1	2.6	328.4	323.0	.1
C312	1.8	16.8	328.4	307.4	.1
C317	1.7	2.8	359.1	322.0	.1
C318	1.7	2.7	322.0	300.0	.1
C325	.8	287.6	322.6	321.8	.1
C405	.9	2.7	410.0	389.1	.1
c406	.9	2.5	389.1	303.6	.1
C412	.0	7.1	363.3	301.0	.1
C414	3.0	12.7	337.1	307.3	.1
C418	3.1	2.5	307.1	304.5	.1
HC01	.9	2.2	296.3	292.6	.1
HC03	3.2	2.5	304.2	296.1	.1

HC04	3.2	2.4	296.1	288.2	.1
SC403	.3	2.6	336.6	331.6	.1
SC404	.3	2.6	331.6	300.0	.1
SC408	1.5	304.2	318.8	317.8	.1
SC412	.1	2.5	318.8	300.0	.1

=====

=====

DETAILS OF COLD STREAMS

-----

=====

=====

ST NAME	FLOWRATE	MCP	INLET T	OUTLET T	FILM COEFFICIENT
---------	----------	-----	---------	----------	------------------

=====

=====

C315	1.8	2.7	307.4	345.2	.1
C323	.8	237.6	359.1	360.1	.1
C401	2.4	2.3	282.6	283.9	.1
C402	2.4	2.3	283.9	295.8	.1
C403	2.4	2.3	295.8	305.2	.1
C408	3.2	5.4	405.0	461.0	.1
C410	.9	8.2	363.3	403.8	.1
HC29	1.2	111.1	280.0	281.0	.1
SC401	.5	2.6	319.6	323.2	.1
SC406	1.5	306.9	336.6	337.6	.1

=====

MINIMUM DELTA T FOR THE MATCHES IS 13.00 DEG

PINCH LOCATED

PINCH TEMPERATURE = 343.112700

ALL STRMS EXHAUSTED

.0	.0	.0	.0	10.0	1.0	1.0	2.0	6.0	7.0
.0	.0	.0	.0	451.3	2.4	2.3	190.4	17.3	7.0
.0	.0	.0	.0	343.3	358.4	344.9	365.6	411.5	377.3
.0	.0	.0	.0	349.6	.0	.0	190.4	969.8	232.3
4.0	4.7	352.6	.0	44.5	.0	.0	.0	.0	.0
8.0	2.4	382.6	.0	57.2	33.7	.0	.0	.0	.0
9.0	.3	356.8	.0	.0	.0	.0	.0	.0	.0
7.0	2.5	403.5	.0	.0	.0	.0	.0	.0	52.4

HEAT EXCHANGER SUMMARY ABOVE THE PINCH

=====

HEX CS HS HEAT THIN THOUT TCIN TCOUT CPH CPC AREA

=====

- 1. SC406 C317 .445E+02 359.07 349.61 336.61 336.71 .47E+01 .45E+03  
57.313
- 2. C315 c406 .236E+01 350.61 349.61 336.61 337.61 .24E+01 .24E+01  
4.040
- 3. C315 C412 .230E+01 357.31 349.61 336.61 337.61 .30E+00 .23E+01  
3.176

4. C315 c406 .337E+02 364.88 350.61 337.61 351.88 .24E+01 .24E+01  
57.652

5. C315 C412 .180E+01 363.33 357.31 337.61 338.39 .30E+00 .23E+01  
1.800

6. SC406 c406 .572E+02 389.08 364.88 336.71 336.84 .24E+01 .45E+03  
32.604

7. C410 C405 .524E+02 410.00 389.08 363.33 370.77 .25E+01 .70E+01  
45.467

=====  
=====

HEATER SUMMARY ABOVE THE PINCH

=====  
=

HEATER	CNO	HEAT	TCIN	TCOUT	CPC
--------	-----	------	------	-------	-----

=====  
=

1.0	2.0	190.4	359.1	360.1	190.4
2.0	6.0	969.8	405.0	461.0	17.3
3.0	7.0	232.3	370.8	403.8	7.0
4.0	10.0	349.6	336.8	337.6	451.3

=====  
=====

ALL STRMS EXHAUSTED

.0	.0	.0	.0	1.0	3.0	4.0	5.0	8.0	9.0
.0	.0	.0	.0	4.7	5.4	5.4	5.5	136.7	1.2
.0	.0	.0	.0	313.9	289.1	290.4	302.3	286.5	326.1
.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4.0	4.7	315.5	.0	130.2	.0	.0	.0	.0	.0
8.0	2.4	343.1	108.8	.0	.0	.0	.0	.0	.0
9.0	.3	343.1	14.5	.0	.0	.0	.0	.0	.0
1.0	69.8	342.9	1468.5	.0	.0	.0	.0	.0	.0
2.0	8.1	319.4	23.9	.0	.0	.0	.0	20.1	.0

3.0	29.4	321.9	619.3	.0	.0	.0	.0	.0	.0
5.0	4.5	302.5	40.6	6.3	.0	.0	52.1	.0	.0
6.0	235.3	315.3	.0	.0	7.1	64.5	.0	116.6	.0
10.0	38.0	330.5	1130.5	.0	.0	.0	.0	.0	3.0
11.0	7.8	300.6	20.6	.0	.0	.0	.0	.0	.0
12.0	1.9	289.8	7.1	.0	.0	.0	.0	.0	.0
13.0	8.0	297.7	64.9	.0	.0	.0	.0	.0	.0
14.0	7.9	289.6	62.0	.0	.0	.0	.0	.0	.0
15.0	.8	328.7	3.0	.0	.0	.0	.0	.0	.0
16.0	.8	325.1	25.4	.0	.0	.0	.0	.0	.0
17.0	447.3	312.3	447.3	.0	.0	.0	.0	.0	.0
18.0	.4	312.3	6.8	.0	.0	.0	.0	.0	.0

HEAT EXCHANGER SUMMARY BELOW PINCH

=====

HEX CS HS HEAT THIN THOUT TCIN TCOUT CPH CPC AREA

=====

8. C315 C317 .130E+03 349.61 321.95 308.72 336.61 .47E+01 .47E+01  
220.532

9. SC401 SC403 .120E+01 336.61 335.15 322.15 323.17 .82E+00 .12E+01  
2.017

10. SC401 C414 .300E+01 337.09 337.01 319.60 322.15 .38E+02 .12E+01  
4.133

11. C315 C318 .633E+01 321.95 320.55 307.36 308.72 .45E+01 .47E+01  
10.639

12. C403 C318 .521E+02 320.55 309.00 295.81 305.25 .45E+01 .55E+01  
81.476

13. C402 C325 .645E+02 322.60 322.33 283.92 295.81 .24E+03 .54E+01  
44.466

14. C401 C325 .713E+01 322.33 322.30 282.60 283.92 .24E+03 .54E+01  
4.056

15. HC29 C325 .117E+03 322.30 321.80 280.15 281.00 .24E+03 .14E+03  
62.499

16. HC29 C308 .201E+02 328.40 325.93 280.00 280.15 .81E+01 .14E+03  
9.486

=====  
=====

COOLER SUMMARY BELOW THE PINCH

=====  
=  
COOLER CNO HEAT THIN THOUT CPH  
=====  
=

1.0	1.0	1468.5	349.4	328.4	69.8
2.0	2.0	23.9	325.9	323.0	8.1
3.0	3.0	619.3	328.4	307.4	29.4
4.0	5.0	40.6	309.0	300.0	4.5
5.0	8.0	108.8	349.6	303.6	2.4
6.0	9.0	14.5	349.6	301.0	.3
7.0	10.0	1130.5	337.0	307.3	38.0
8.0	11.0	20.6	307.1	304.5	7.8
9.0	12.0	7.1	296.3	292.6	1.9
10.0	13.0	64.9	304.2	296.1	8.0
11.0	14.0	62.0	296.1	288.2	7.9
12.0	15.0	3.0	335.2	331.6	.8

13.0	16.0	25.4	331.6	300.0	.8
14.0	17.0	447.3	318.8	317.8	447.3
15.0	18.0	6.8	318.8	300.0	.4

=====

=

=====

LOOP#	HEAT EXCHANGERS INVOLVED
1	5 3
2	4 1 6 8
5	2 1 6 8

=====

THE MINIMUM HOT UTILITY REQUIREMENT IS: 1742.152000

THE MINIMUM COLD UTILITY REQUIREMENT IS: 4043.175000