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APPENDICES

Appendix A Keyword input file for gas separation plant I simulation.

Input Summary created by Aspen Plus Rel. 11.1 at 12:30:16 Thu Feb 26, 2004

DYNAPLUS DPLUS RESULTS=ON

TITLE 'gas separation plant'

IN-UNITS SI MOLE-FLOW='mol/sec' VOLUME-FLOW='cum/hr' &
ENTHALPY-FLO=kW PRESSURE=barg ELEC-POWER=kW HEAT=kJ &
PDROP=bar

DEF-STREAMS CONVEN ALL

DESCRIPTION

" Gas Processing with Metric Units:
C, bar, tonne/hr, MMscmh, MMkcal/hr, cum/hr.

Property Method: PENG-ROB

Flow basis for input: Mole

Stream report composition: Mole flow "

DATABANKS PURE11 / AQUEOUS / SOLIDS / INORGANIC / &
NOASPENPCD

PROP-SOURCES PURE11 / AQUEOUS / SOLIDS / INORGANIC

COMPONENTS

NITRO-01 N2 /
METHA-01 CH4 /
ETHAN-01 C2H6 /
PROPA-01 C3H8 /
ISOBU-01 C4H10-2 /
N-BUT-01 C4H10-1 /
2-MET-01 C5H12-2 /
N-PEN-01 C5H12-1 /
N-HEX-01 C6H14-1 /
N-HEP-01 C7H16-1 /
N-OCT-01 C8H18-1 /
CARBO-01 CO2 /
PROPY-01 C3H6-2

FLWSHEET

BLOCK D70301 IN=S70201-1 OUT=S70301 S70302
 BLOCK E70304 IN=S70301-1 OUT=S70301-2
 BLOCK D70302 IN=S70301-2 OUT=S70303 S70304
 BLOCK V3 IN=S70302 OUT=S70324
 BLOCK V2 IN=S70304 OUT=S70325
 BLOCK D70303 IN=S70303-1 OUT=S70305 S70306
 BLOCK V1 IN=S70306 OUT=S70326
 BLOCK X70301 IN=S70305 OUT=S70307
 BLOCK T70301 IN=S70307 S70324 S70325 S70326 S70313 S70315 &
 S70317 S70320 OUT=S70308 S70321 S70312 S70314 S70316 &
 S70318
 BLOCK P70305 IN=S70312 OUT=S70312-1
 BLOCK P70304 IN=S70314 OUT=S70314-1
 BLOCK P70303 IN=S70316 OUT=S70316-1
 BLOCK P70302 IN=S70318 OUT=S70318-1
 BLOCK B1 IN=S70308 OUT=S70308-1 S70308-2
 BLOCK B3 IN=S70308-2 S70309-1 OUT=S70309
 BLOCK E302 IN=S70303 S70308-1 S70312-1 S70314-1 OUT= &
 S70303-1 S70309-1 S70313 S70315
 BLOCK P70301 IN=S70321 OUT=S70322
 BLOCK SP8 IN=S70323 OUT=S70422 S70323-1
 BLOCK H5 IN=S70422-1 S70419 OUT=S70423
 BLOCK T70401 IN=S70401 OUT=S70404 S70406
 BLOCK V401 IN=S70404 OUT=S70327
 BLOCK E301 IN=S70201 S70301 S70322 S70309 S70316-1 &
 S70318-1 S70327 OUT=S70201-1 S70301-1 S70323 S70310 &
 S70319 S70328 S70317
 BLOCK C70301 IN=S70310 OUT=S70311
 BLOCK B6 IN=S70311 OUT=PURGE S70601
 BLOCK C70601 IN=S70601 OUT=S70602
 BLOCK SP9 IN=S70602 OUT=S70602-1 S70602-2
 BLOCK E70404 IN=S70602-1 S70407 OUT=S70603 S70408
 BLOCK V70406 IN=S70406 OUT=S70407
 BLOCK M5 IN=S70603 S70602-2 OUT=S70603M
 BLOCK T70402 IN=S70408 S70420 OUT=S70409 S70416 S70415
 BLOCK E70405 IN=S70409 OUT=S70409-1
 BLOCK D70402 IN=S70409-1 OUT=S70410 S70411
 BLOCK P70402 IN=S70411 OUT=S70411-1
 BLOCK SP2 IN=S70412 OUT=S70420-1 S70413
 BLOCK E406 IN=S70422 S70411-1 S70415 REF-IN OUT=S70422-1 &
 S70412 S70415P REF-OUT
 BLOCK E70409 IN=S70416 OUT=S70417
 BLOCK E70407 IN=S70417 S70323-1 OUT=S70418P S70419
 BLOCK SP4 IN=S70603M OUT=S70605 S70603-1
 BLOCK E70303 IN=S70605 S70319 OUT=S70606 S70320
 BLOCK SP5 IN=S70603-1 OUT=S70607 S70603-2

BLOCK E70408 IN=S70607 S70423 OUT=S70608 S70401
 BLOCK E70601 IN=S70603-2 OUT=S70603-3
 BLOCK M6 IN=S70608 S70606 OUT=S70608-1
 BLOCK M4 IN=S70608-1 S70603-3 OUT=S70604

PROPERTIES PENG-ROB

PROP-DATA PRKIJ-1

IN-UNITS MET MASS-FLOW='tonne/hr' MOLE-FLOW=MMscmh &
 VOLUME-FLOW='cum/hr' ENTHALPY-FLO='MMkcal/hr' &
 HEAT-TRANS-C='kcal/hr-sqm-K' MASS=tonne PRESSURE=bar &
 TEMPERATURE=C VOLUME=cum DELTA-T=C HEAD=meter &
 MOLE-DENSITY='kmol/cum' MASS-DENSITY='kg/cum' &
 MOLE-ENTHALP='kcal/mol' MASS-ENTHALP='kcal/kg' &
 MOLE-VOLUME='cum/kmol' MOLES=MMscm HEAT=MMkcal &
 MASS-CONC='kg/cum' MOLE-CONC='kmol/cum' PDROP=bar &
 VOL-HEAT-CAP='kcal/cum-K'

PROP-LIST PRKIJ

BPVAL NITRO-01 METHA-01 .0311000000
 BPVAL NITRO-01 ETHAN-01 .0515000000
 BPVAL NITRO-01 PROPA-01 .0852000000
 BPVAL NITRO-01 ISOBU-01 .1033000000
 BPVAL NITRO-01 N-BUT-01 .0800000000
 BPVAL NITRO-01 2-MET-01 .0922000000
 BPVAL NITRO-01 N-PEN-01 .1000000000
 BPVAL NITRO-01 N-HEX-01 .1496000000
 BPVAL NITRO-01 N-HEP-01 .1441000000
 BPVAL NITRO-01 N-OCT-01 -.4100000000
 BPVAL NITRO-01 CARBO-01 -.0170000000
 BPVAL NITRO-01 PROPY-01 .0900000000
 BPVAL METHA-01 NITRO-01 .0311000000
 BPVAL METHA-01 ETHAN-01 -2.6000000E-3
 BPVAL METHA-01 PROPA-01 .0140000000
 BPVAL METHA-01 ISOBU-01 .0256000000
 BPVAL METHA-01 N-BUT-01 .0133000000
 BPVAL METHA-01 2-MET-01 -5.6000000E-3
 BPVAL METHA-01 N-PEN-01 .0230000000
 BPVAL METHA-01 N-HEX-01 .0422000000
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 BPVAL METHA-01 N-OCT-01 .0496000000
 BPVAL METHA-01 CARBO-01 .0919000000
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 BPVAL ETHAN-01 METHA-01 -2.6000000E-3
 BPVAL ETHAN-01 NITRO-01 .0515000000
 BPVAL ETHAN-01 PROPA-01 1.10000000E-3
 BPVAL ETHAN-01 ISOBU-01 -6.7000000E-3
 BPVAL ETHAN-01 N-BUT-01 9.60000000E-3

BPVAL ETHAN-01 N-PEN-01 7.80000000E-3
BPVAL ETHAN-01 N-HEX-01 -.0100000000
BPVAL ETHAN-01 N-HEP-01 6.70000000E-3
BPVAL ETHAN-01 N-OCT-01 .0185000000
BPVAL ETHAN-01 CARBO-01 .1322000000
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BPVAL ISOBU-01 PROPY-01 -.0144000000
BPVAL N-BUT-01 METHA-01 .0133000000
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BPVAL N-BUT-01 CARBO-01 .1333000000
BPVAL 2-MET-01 METHA-01 -5.60000000E-3
BPVAL 2-MET-01 NITRO-01 .0922000000
BPVAL 2-MET-01 PROPA-01 .0111000000
BPVAL 2-MET-01 N-PEN-01 0.0
BPVAL 2-MET-01 CARBO-01 .1219000000
BPVAL N-PEN-01 METHA-01 .0230000000
BPVAL N-PEN-01 NITRO-01 .1000000000
BPVAL N-PEN-01 ETHAN-01 7.80000000E-3
BPVAL N-PEN-01 PROPA-01 .0267000000
BPVAL N-PEN-01 N-BUT-01 .0174000000
BPVAL N-PEN-01 2-MET-01 0.0
BPVAL N-PEN-01 N-HEP-01 7.40000000E-3
BPVAL N-PEN-01 N-OCT-01 0.0
BPVAL N-PEN-01 CARBO-01 .1222000000

BPVAL N-HEX-01 METHA-01 .0422000000
 BPVAL N-HEX-01 NITRO-01 .1496000000
 BPVAL N-HEX-01 ETHAN-01 -.0100000000
 BPVAL N-HEX-01 PROPA-01 7.00000000E-4
 BPVAL N-HEX-01 N-BUT-01 -5.6000000E-3
 BPVAL N-HEX-01 N-HEP-01 -7.8000000E-3
 BPVAL N-HEX-01 CARBO-01 .1100000000
 BPVAL N-HEP-01 METHA-01 .0352000000
 BPVAL N-HEP-01 NITRO-01 .1441000000
 BPVAL N-HEP-01 ETHAN-01 6.70000000E-3
 BPVAL N-HEP-01 PROPA-01 5.60000000E-3
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 BPVAL N-HEP-01 CARBO-01 .1000000000
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 BPVAL N-OCT-01 NITRO-01 -.4100000000
 BPVAL N-OCT-01 ETHAN-01 .0185000000
 BPVAL N-OCT-01 N-PEN-01 0.0
 BPVAL CARBO-01 METHA-01 .0919000000
 BPVAL CARBO-01 NITRO-01 -.0170000000
 BPVAL CARBO-01 ETHAN-01 .1322000000
 BPVAL CARBO-01 PROPA-01 .1241000000
 BPVAL CARBO-01 ISOBU-01 .1200000000
 BPVAL CARBO-01 N-BUT-01 .1333000000
 BPVAL CARBO-01 2-MET-01 .1219000000
 BPVAL CARBO-01 N-PEN-01 .1222000000
 BPVAL CARBO-01 N-HEX-01 .1100000000
 BPVAL CARBO-01 N-HEP-01 .1000000000
 BPVAL CARBO-01 PROPY-01 .0933000000
 BPVAL PROPY-01 METHA-01 .0330000000
 BPVAL PROPY-01 NITRO-01 .0900000000
 BPVAL PROPY-01 ETHAN-01 8.90000000E-3
 BPVAL PROPY-01 PROPA-01 7.40000000E-3
 BPVAL PROPY-01 ISOBU-01 -.0144000000
 BPVAL PROPY-01 CARBO-01 .0933000000

PROP-SET GASPROPS

IN-UNITS MET MASS-FLOW='tonne/hr' MOLE-FLOW=MMscmh &
 VOLUME-FLOW='cum/hr' ENTHALPY-FLO='MMkcal/hr' &
 HEAT-TRANS-C='kcal/hr-sqm-K' MASS=tonne PRESSURE=bar &
 TEMPERATURE=C VOLUME=cum DELTA-T=C HEAD=meter &
 MOLE-DENSITY='kmol/cum' MASS-DENSITY='kg/cum' &
 MOLE-ENTHALP='kcal/mol' MASS-ENTHALP='kcal/kg' &
 MOLE-VOLUME='cum/kmol' MOLES=MMscm HEAT=MMkcal &
 MASS-CONC='kg/cum' MOLE-CONC='kmol/cum' PDROP=bar &

VOL-HEAT-CAP='kcal/cum-K'
 PROPNAME-LIS ZMX VMX MOLEFLMX CPCVMX UNITS='cum/hr' &
 'MMscmh' SUBSTREAM=MIXED PHASE=V
 ; "Compressibility, volume flow, heat capacity ratio"

Streams descriptions

STREAM REF-IN

SUBSTREAM MIXED TEMP=313. PRES=17. MASS-FLOW=102069. <kg/hr>
 MOLE-FRAC PROPY-01 1.

STREAM S70201

SUBSTREAM MIXED TEMP=290.32282 PRES=43.4 &
 MOLE-FLOW=4494.29358
 MOLE-FRAC NITRO-01 0.02451428 / METHA-01 0.77988855 / &
 ETHAN-01 0.10045855 / PROP A-01 0.05564571 / ISOB U-01 &
 0.01312714 / N-BUT-01 0.01199571 / 2-MET-01 0.00369714 / &
 N-PEN-01 0.00238571 / N-HEX-01 0.00170571 / N-HEP-01 &
 0.0009 / CARBO-01 0.00568142

STREAM S70308

SUBSTREAM MIXED TEMP=175.605388 PRES=15. &
 MOLE-FLOW=3711.13931
 MOLE-FRAC NITRO-01 0.02968748 / METHA-01 0.94093581 / &
 ETHAN-01 0.0249106 / PROP A-01 0.000478 / ISOB U-01 &
 3.2631E-006 / N-BUT-01 8.4867E-007 / 2-MET-01 &
 3.4946E-009 / N-PEN-01 1.0295E-009 / N-HEX-01 &
 1.4222E-012 / N-HEP-01 4.127E-015 / N-OCT-01 0. / &
 CARBO-01 0.00398398

STREAM S70312

SUBSTREAM MIXED TEMP=201.660136 PRES=15.0341026 &
 MOLE-FLOW=550.000001
 MOLE-FRAC NITRO-01 0.00027393 / METHA-01 0.26844955 / &
 ETHAN-01 0.52317309 / PROP A-01 0.15105915 / ISOB U-01 &
 0.01268875 / N-BUT-01 0.00781298 / 2-MET-01 0.00058239 / &
 N-PEN-01 0.00026984 / N-HEX-01 1.476E-005 / N-HEP-01 &
 9.596E-007 / N-OCT-01 0. / CARBO-01 0.03567455

STREAM S70314

SUBSTREAM MIXED TEMP=226.305362 PRES=15.0462821 &
 MOLE-FLOW=507.
 MOLE-FRAC NITRO-01 0.00020708 / METHA-01 0.14497659 / &
 ETHAN-01 0.51771718 / PROP A-01 0.24376767 / ISOB U-01 &
 0.03636337 / N-BUT-01 0.02769172 / 2-MET-01 0.00449359 / &
 N-PEN-01 0.00246237 / N-HEX-01 0.00053437 / N-HEP-01 &
 0.00010463 / CARBO-01 0.0216814

STREAM S70316

SUBSTREAM MIXED TEMP=261.304499 PRES=15.0682051 &
MOLE-FLOW=909.999702
MOLE-FRAC NITRO-01 9.0908E-009 / METHA-01 0.04761185 / &
ETHAN-01 0.48283045 / PROPA-01 0.28420954 / ISOBU-01 &
0.06480775 / N-BUT-01 0.05891293 / 2-MET-01 0.01794846 / &
N-PEN-01 0.01156545 / N-HEX-01 0.00822819 / N-HEP-01 &
0.00433705 / N-OCT-01 0. / PROPY-01 0.01954828

STREAM S70318

SUBSTREAM MIXED TEMP=275.894692 PRES=15.0925641 &
MOLE-FLOW=800.000063
MOLE-FRAC NITRO-01 1.1614E-010 / METHA-01 0.0190557 / &
ETHAN-01 0.46276073 / PROPA-01 0.31330885 / ISOBU-01 &
0.07401034 / N-BUT-01 0.0675907 / 2-MET-01 0.02079856 / &
N-PEN-01 0.01341827 / N-HEX-01 0.0095866 / N-HEP-01 &
0.00505742 / CARBO-01 0.01441279

STREAM S70320

SUBSTREAM MIXED TEMP=280.33697 PRES=15. MOLE-
FLOW=799.999996
MOLE-FRAC NITRO-01 1.1613E-010 / METHA-01 0.0190555 / &
ETHAN-01 0.46276097 / PROPA-01 0.31330901 / ISOBU-01 &
0.07401031 / N-BUT-01 0.06759045 / 2-MET-01 0.02079852 / &
N-PEN-01 0.01341823 / N-HEX-01 0.00958652 / N-HEP-01 &
0.0050574 / CARBO-01 0.01441305

STREAM S70321

SUBSTREAM MIXED TEMP=277.381 PRES=15.095 &
MOLE-FLOW=783.154033
MOLE-FRAC NITRO-01 7.99E-011 / METHA-01 0.01673432 / &
ETHAN-01 0.45845753 / PROPA-01 0.31706907 / ISOBU-01 &
0.07531728 / N-BUT-01 0.06883588 / 2-MET-01 0.02121677 / &
N-PEN-01 0.01369087 / N-HEX-01 0.00978859 / N-HEP-01 &
0.00516483 / N-OCT-01 0. / CARBO-01 0.01372482

STREAM S70404

SUBSTREAM MIXED TEMP=271.080326 PRES=27.51313 &
MOLE-FLOW=340.774601
MOLE-FRAC NITRO-01 1.8362E-010 / METHA-01 0.03845813 / &
ETHAN-01 0.92999999 / PROPA-01 4.6768E-008 / ISOBU-01 &
2.1563E-017 / N-BUT-01 6.0191E-019 / 2-MET-01 &
4.7116E-028 / N-PEN-01 4.1943E-030 / N-HEX-01 &
2.3124E-035 / N-HEP-01 2.2186E-035 / N-OCT-01 0. / &
CARBO-01 0.03154182

STREAM S70406

SUBSTREAM MIXED TEMP=358.827756 PRES=28.1468826 &
MOLE-FLOW=442.379432
MOLE-FRAC NITRO-01 4.8563E-035 / METHA-01 8.8323E-030 / &
ETHAN-01 0.09521801 / PROPA-01 0.5613143 / ISOBU-01 &
0.13333584 / N-BUT-01 0.12186168 / 2-MET-01 0.03756052 / &
N-PEN-01 0.02423726 / N-HEX-01 0.01732895 / N-HEP-01 &
0.00914341 / CARBO-01 2.8718E-017

STREAM S70420

SUBSTREAM MIXED TEMP=295.31177 PRES=16. MOLE-FLOW=600.96
MOLE-FRAC ETHAN-01 0.00368293 / PROPA-01 0.99631706 / &
ISOBU-01 2.1144E-011 / N-BUT-01 3.1548E-014

Unit Operation Blocks

BLOCK B3 MIXER

BLOCK H5 MIXER

BLOCK M4 MIXER

BLOCK M5 MIXER

BLOCK M6 MIXER

BLOCK B1 FSPLIT
MOLE-FLOW S70308-1 3380.

BLOCK B6 FSPLIT
MOLE-FLOW PURGE 60.

BLOCK SP2 FSPLIT
MOLE-FLOW S70420-1 600.96

BLOCK SP4 FSPLIT
MOLE-FLOW S70605 14.18

BLOCK SP5 FSPLIT
MOLE-FLOW S70607 340.7

BLOCK SP8 FSPLIT
MOLE-FLOW S70323-1 26.8178

BLOCK SP9 FSPLIT
MOLE-FLOW S70602-2 750.

BLOCK E70304 HEATER

PARAM TEMP=233.9 DPPARM=0.

BLOCK E70405 HEATER

PARAM TEMP=313.09254 DPPARM=0.

BLOCK E70409 HEATER

PARAM TEMP=317.81069 DPPARM=0.

BLOCK E70601 HEATER

PARAM TEMP=299.5 PRES=42.77251

BLOCK D70301 FLASH2

PARAM TEMP=255.45733 PRES=43.1

BLOCK D70302 FLASH2

PARAM TEMP=233.9 PRES=40.5

BLOCK D70303 FLASH2

PARAM TEMP=205.55302 PRES=39.37118

BLOCK D70402 FLASH2

PARAM TEMP=313.09254 PRES=15.06215

BLOCK E70303 HEATX

PARAM T-COLD=280.33697

FEEDS HOT=S70605 COLD=S70319

PRODUCTS HOT=S70606 COLD=S70320

BLOCK E70404 HEATX

PARAM T-HOT=358.306 CALC-TYPE=DESIGN PRES-HOT=42.77252 &

U-OPTION=CONSTANT F-OPTION=CONSTANT CALC-

METHOD=SHORTCUT

FEEDS HOT=S70602-1 COLD=S70407

PRODUCTS HOT=S70603 COLD=S70408

HEAT-TR-COEF U=800.

EQUIP-SPECS

TUBES OUTSIDE-DIAM=25.4 <mm> WALL-THICK=2.77 <mm>

HOT-SIDE DP-OPTION=CONSTANT

COLD-SIDE DP-OPTION=CONSTANT

BLOCK E70407 HEATX

PARAM T-COLD=313.63338

FEEDS HOT=S70417 COLD=S70323-1

PRODUCTS HOT=S70418P COLD=S70419

BLOCK E70408 HEATX

PARAM T-COLD=317.34881
 FEEDS HOT=S70607 COLD=S70423
 PRODUCTS HOT=S70608 COLD=S70401

BLOCK E301 MHEATX

HOT-SIDE IN=S70201 OUT=S70201-1 TEMP=255.45733 PRES=43.4 &
 FREE-WATER=NO
 HOT-SIDE IN=S70301 OUT=S70301-1 PRES=41. FREE-WATER=NO
 COLD-SIDE IN=S70322 OUT=S70323 TEMP=278.95039 PRES=30.1 &
 FREE-WATER=NO
 COLD-SIDE IN=S70309 OUT=S70310 TEMP=288.58948 PRES=14.5 &
 FREE-WATER=NO
 COLD-SIDE IN=S70316-1 OUT=S70317 TEMP=271.14474 PRES=15. &
 FREE-WATER=NO
 COLD-SIDE IN=S70318-1 OUT=S70319 TEMP=280.14273 PRES=15. &
 FREE-WATER=NO
 COLD-SIDE IN=S70327 OUT=S70328 TEMP=286.44713 PRES=10.7 &
 FREE-WATER=NO

BLOCK E302 MHEATX

HOT-SIDE IN=S70303 OUT=S70303-1 PRES=40. FREE-WATER=NO
 COLD-SIDE IN=S70308-1 OUT=S70309-1 TEMP=233.79978 PRES=15. &
 FREE-WATER=NO
 COLD-SIDE IN=S70312-1 OUT=S70313 TEMP=225.89399 PRES=15. &
 FREE-WATER=NO
 COLD-SIDE IN=S70314-1 OUT=S70315 TEMP=233.51868 PRES=15. &
 FREE-WATER=NO

BLOCK E406 MHEATX

COLD-SIDE IN=S70422 OUT=S70422-1 TEMP=314.7259 PRES=29.9 &
 FREE-WATER=NO
 HOT-SIDE IN=S70411-1 OUT=S70412 TEMP=295.31177 PRES=16. &
 FREE-WATER=NO
 HOT-SIDE IN=S70415 OUT=S70415P TEMP=292.07 PRES=16. &
 FREE-WATER=NO
 HOT-SIDE IN=REF-IN OUT=REF-OUT PRES=11.06 FREE-WATER=NO

BLOCK T70301 RADFRAC

PARAM NSTAGE=40 EFF=MURPHREE MAXOL=30
 COL-CONFIG CONDENSER=NONE
 FEEDS S70307 1 / S70324 21 / S70325 16 / S70326 7 / &
 S70313 16 / S70315 21 / S70317 30 / S70320 39
 PRODUCTS S70308 1 V / S70321 40 L / S70312 15 L &
 MOLE-FLOW=550. / S70314 20 L MOLE-FLOW=507. / S70316 &
 29 L MOLE-FLOW=910. / S70318 39 L MOLE-FLOW=800.
 P-SPEC 1 15.
 COL-SPECS QN=2702. DP-COL=0.095

SC-REFLUX TEMP=175.121

HEATERS 15 -300.

HEATERS 20 170.

HEATERS 29 1500.

HEATERS 39 -290.

T-EST 1 175.6 / 2 176.6 / 3 177. / 4 177.5 / 5 &
 177.9 / 6 178.5 / 7 180. / 8 180.2 / 9 180.5 / &
 10 181. / 11 182. / 12 183.9 / 13 187.4 / 14 &
 193.3 / 15 201.7 / 16 220.7 / 17 221.3 / 18 &
 222.2 / 19 223.4 / 20 226.3 / 21 234.8 / 22 235. / &
 23 235.4 / 24 236.1 / 25 237.4 / 26 239.7 / 27 &
 243.7 / 28 250. / 29 261.3 / 30 271. / 31 271. / &
 32 271. / 33 271.1 / 34 271.2 / 35 271.3 / 36 &
 271.6 / 37 272.1 / 38 273.2 / 39 275.9 / 40 &
 277.4

SPEC 1 TEMP 277.381 STAGE=40

VARY 1 QN 100. 5000.

STEFF-SEC SECNO=1 1 40 0.67

BLOCK T70401 RADFRAC

PARAM NSTAGE=89 EFF=MURPHREE MAXOL=50

COL-CONFIG CONDENSER=TOTAL

FEEDS S70401 30

PRODUCTS S70404 1 L / S70406 89 L

P-SPEC 1 27.51313

COL-SPECS Q1=-10080. DP-COL=0.63375258 MOLE-B=347.

T-EST 1 271.1 / 2 277. / 3 278.5 / 4 278.9 / 5 &
 279.1 / 6 279.1 / 7 279.2 / 8 279.2 / 9 279.2 / &
 10 279.2 / 11 279.2 / 12 279.2 / 13 279.2 / 14 &
 279.2 / 15 279.3 / 16 279.3 / 17 279.3 / 18 &
 279.4 / 19 279.4 / 20 279.5 / 21 279.7 / 22 280. / &
 23 280.6 / 24 281.5 / 25 283. / 26 285.4 / 27 &
 288.9 / 28 293.8 / 29 300.3 / 30 309. / 31 309.7 / &
 32 309.9 / 33 310.1 / 34 310.2 / 35 310.2 / 36 &
 310.2 / 37 310.3 / 38 310.3 / 39 310.3 / 40 &
 310.3 / 41 310.3 / 42 310.3 / 43 310.3 / 44 &
 310.4 / 45 310.4 / 46 310.4 / 47 310.4 / 48 &
 310.4 / 49 310.4 / 50 310.4 / 51 310.4 / 52 &
 310.5 / 53 310.5 / 54 310.5 / 55 310.5 / 56 &
 310.5 / 57 310.5 / 58 310.5 / 59 310.5 / 60 &
 310.5 / 61 310.6 / 62 310.6 / 63 310.6 / 64 &
 310.6 / 65 310.6 / 66 310.6 / 67 310.6 / 68 &
 310.6 / 69 310.7 / 70 310.7 / 71 310.7 / 72 &
 310.7 / 73 310.7 / 74 310.8 / 75 310.8 / 76 &
 310.9 / 77 311.1 / 78 311.3 / 79 311.7 / 80 &
 312.4 / 81 313.4 / 82 315. / 83 317.4 / 84 320.8 / &
 85 325.5 / 86 331.4 / 87 338.4 / 88 347. / 89 &

358.8

SPEC 1 MOLE-FRAC 0.93 COMPS=ETHAN-01 STREAMS=S70404
VARY 1 MOLE-B 200. 500.
STEFF-SEC SECNO=1 1 89 0.99

BLOCK T70402 RADFRAC
PARAM NSTAGE=80
COL-CONFIG CONDENSER=NONE
FEEDS S70408 56 / S70420 1
PRODUCTS S70409 1 V / S70416 80 L / S70415 41 L &
MOLE-FLOW=254.236
P-SPEC 1 15.56215
COL-SPECS DP-COL=0.52955596 MOLE-D=590.104
SPEC 1 TEMP 437.7359 STAGE=80
VARY 1 MOLE-D 400. 1000.

BLOCK P70301 PUMP
PARAM PRES=30.4

BLOCK P70302 PUMP
PARAM PRES=15.2

BLOCK P70303 PUMP
PARAM PRES=15.

BLOCK P70304 PUMP
PARAM PRES=15.2

BLOCK P70305 PUMP
PARAM PRES=15.2

BLOCK P70402 PUMP
PARAM PRES=16.5

BLOCK C70301 COMPR
PARAM TYPE=ISENTROPIC PRES=17.9 SEFF=0.77

BLOCK C70601 COMPR
PARAM TYPE=ISENTROPIC PRES=45. SEFF=0.714

BLOCK X70301 COMPR
PARAM TYPE=ISENTROPIC PRES=16. NPHASE=2
BLOCK-OPTION FREE-WATER=NO

BLOCK V1 VALVE
PARAM P-OUT=15.

BLOCK V2 VALVE
PARAM P-OUT=15.

BLOCK V3 VALVE
PARAM P-OUT=15.

BLOCK V401 VALVE
PARAM P-OUT=14.6

BLOCK V70406 VALVE
PARAM P-OUT=24.7

EO-CONV-OPTI

CONV-OPTIONS
WEGSTEIN MAXIT=150

STREAM-REPOR MOLEFLOW MOLEFRAC PROPERTIES=GASPROPS

Appendix B Stream results from simulation model.

The results of each stream compose of temperature, pressure, flow rate, composition and selected properties.

The stream results were shown in Table form as shown in Table B1 and the stream name was assigned according to the plant flow sheet as shown in Figure B1.

For feed and product streams, the stream name are assigned as followed:

Stream name of feed stream	=	S70201
Stream name of sale gas product	=	S70604
Stream name of ethane product	=	S70328
Stream name of propane product	=	S70413
Stream name of LPG product	=	S70415
Stream name of natural gasoline product	=	S70418

Table B1 Stream results from simulation

	PURGE	REF-IN	REF-OUT	S70201	S70201-1	S70301	S70301-1	S70301-2	S70302	S70303
Temperature K	306.395091	313	299.975986	290.3228	255.4573	255.45733	244.197738	233.9	255.4573	233.9
Pressure barg	17.9	17	11.06	43.4	43.4	43.1	41	41	43.1	40.5
Vapor Frac	1	0	0.10447275	0.996875	0.91428	1	0.97368842	0.9342267	0	1
Mole Flow mol/sec	60	673.7659	673.765899	4494.294	4494.294	4111.68372	4111.68372	4111.68372	382.6099	3845.75959
Mole Flow MMscmh	0.00484134		0.00567971	0.361507	0.331554	0.33176766	0.32303833	0.30994621		0.31031051
Mass Flow kg/sec	1.01235379	28.3525	28.3525002	94.64601	94.64601	79.7127257	79.7127257	79.7127257	14.93328	71.1236667
Volume Flow cum/hr	279.9223	212.9003	599.847475	7288.293	5598.345	5543.6006	5347.73053	4800.65104	105.2556	4819.00062
Enthalpy MMkcal/hr	-3.8107127	3.451537	3.39383296	-312.989	-323.167	-283.52137	-286.1061	-289.13057	-39.5904	-263.89487
Mole Frac										
NITRO-01	0.02968749	0	0	0.024514	0.024514	0.02651216	0.02651216	0.02651216	0.003044	0.02809047
METHA-01	0.94093572	0	0	0.779889	0.779889	0.82543101	0.82543101	0.82543101	0.290471	0.85675937
ETHAN-01	0.02491067	0	0	0.100459	0.100459	0.09299105	0.09299105	0.09299105	0.180707	0.08300144
PROPA-01	0.000478	0	0	0.055646	0.055646	0.03796245	0.03796245	0.03796245	0.245677	0.02309937
ISOBU-01	3.26E-06	0	0	0.013127	0.013127	0.00574783	0.00574783	0.00574783	0.092428	0.00200112
N-BUT-01	8.49E-07	0	0	0.011996	0.011996	0.00439216	0.00439216	0.00439216	0.093707	0.00123743
2-MET-01	3.49E-09	0	0	0.003697	0.003697	0.0007193	0.0007193	0.0007193	0.035698	9.34E-05
N-PEN-01	1.03E-09	0	0	0.002386	0.002386	0.00039485	0.00039485	0.00039485	0.02378	4.34E-05
N-HEX-01	1.42E-12	0	0	0.001706	0.001706	8.63E-05	8.63E-05	8.63E-05	0.019108	2.39E-06
N-HEP-01	4.13E-15	0	0	0.0009	0.0009	1.70E-05	1.70E-05	1.70E-05	0.010389	1.55E-07
N-OCT-01	0	0	0	0	0	0	0	0	0	0
CARBO-01	0.00398399	0	0	0.005681	0.005681	0.00574585	0.00574585	0.00574585	0.004989	0.00567142
PROPY-01	0	1	1	0	0	0	0	0	0	0

Table B1 (Continued) Stream results from simulation

	S70303-1	S70304	S70305	S70306	S70307	S70308	S70308-1	S70308-2	S70309	S70309-1
Temperature K	206.064998	233.9	205.55302	205.55302	176.615296	175.605388	175.611752	175.611752	228.400044	233.79978
Pressure barg	40	40.5	39.37118	39.37118	16	15	15	15	15	15
Vapor Frac	0.81773522	0	1	0	0.92647547	1	0.99997122	0.99997122	1	1
Mole Flow mol/sec	3845.75959	265.9241	3143.44005	702.319545	3143.44005	3711.13792	3380	331.137916	3711.13792	3380
Mole Flow MMscmh	0.25375183		0.25364105		0.23499221	0.29944802	0.27272098	0.02671841	0.29944802	0.27272883
Mass Flow kg/sec	71.1236667	8.589059	54.7107756	16.4128911	54.7107756	62.6164091	57.0292636	5.58714541	62.6164091	57.0292636
Volume Flow cum/hr	3197.05412	63.99478	3111.26427	143.655549	7303.15826	9884.00165	9002.45992	881.969176	14524.6283	13627.004
Enthalpy MMkcal/hr	-272.59866	-25.1385	-214.23351	-58.380084	-216.05367	-251.37457	-228.94489	-22.429684	-244.81043	-222.38074
Mole Frac										
NITRO-01	0.02809047	0.003687	0.03280647	0.00698261	0.03280647	0.02968749	0.02968749	0.02968749	0.02968749	0.02968749
METHA-01	0.85675937	0.372364	0.90853863	0.62500591	0.90853863	0.94093572	0.94093572	0.94093572	0.94093572	0.94093572
ETHAN-01	0.08300144	0.237459	0.04844759	0.23765751	0.04844759	0.02491067	0.02491067	0.02491067	0.02491067	0.02491067
PROPA-01	0.02309937	0.25291	0.0052153	0.10314482	0.0052153	0.000478	0.000478	0.000478	0.000478	0.000478
ISOBU-01	0.00200112	0.059932	0.00018094	0.01014789	0.00018094	3.26E-06	3.26E-06	3.26E-06	3.26E-06	3.26E-06
N-BUT-01	0.00123743	0.050015	8.10E-05	0.00641328	8.10E-05	8.49E-07	8.49E-07	8.49E-07	8.49E-07	8.49E-07
2-MET-01	9.34E-05	0.009771	2.09E-06	0.00050225	2.09E-06	3.49E-09	3.49E-09	3.49E-09	3.49E-09	3.49E-09
N-PEN-01	4.34E-05	0.005478	8.28E-07	0.00023384	8.28E-07	1.03E-09	1.03E-09	1.03E-09	1.03E-09	1.03E-09
N-HEX-01	2.39E-06	0.0013	1.12E-08	1.30E-05	1.12E-08	1.42E-12	1.42E-12	1.42E-12	1.42E-12	1.42E-12
N-HEP-01	1.55E-07	0.00026	2.12E-10	8.50E-07	2.12E-10	4.13E-15	4.13E-15	4.13E-15	4.13E-15	4.13E-15
N-OCT-01	0	0	0	0	0	0	0	0	0	0
CARBO-01	0.00567142	0.006822	0.0047271	0.00989799	0.0047271	0.00398399	0.00398399	0.00398399	0.00398399	0.00398399
PROPY-01	0	0	0	0	0	0	0	0	0	0

Table B1 (Continued) Stream results from simulation

	S70310	S70311	S70312	S70312-1	S70313	S70314	S70314-1	S70315	S70316	S70316-1
Temperature K	288.58948	306.394967	201.659995	201.674077	225.89399	226.3053	226.319	233.5187	261.304428	261.300841
Pressure barg	14.5	17.9	15.0341026	15.2	15	15.04628	15.2	15	15.0682051	15
Vapor Frac	1	1	0	0	0.24615065	0	0	0.050404	0	0
Mole Flow mol/sec	3711.13792	3711.13792	550	550	550	507	507	507	910	910
Mole Flow MMscmh	0.29944802	0.29944802			0.0109239			0.002062		
Mass Flow kg/sec	62.6164091	62.6164091	16.2424334	16.2424334	16.2424334	17.1793	17.1793	17.1793	35.6169641	35.6169641
Volume Flow cum/hr	19872.3122	17313.8297	113.57124	113.575606	581.942253	118.9882	118.9925	211.7872	249.250058	249.247564
Enthalpy MMkcal/hr	-237.64126	-235.70134	-53.917929	-53.917297	-52.202976	-50.5389	-50.5383	-50.1129	-95.341903	-95.342218
Mole Frac										
NITRO-01	0.02968749	0.02968749	0.00027393	0.00027393	0.00027393	0.000207	0.000207	0.000207	9.09E-09	9.09E-09
METHA-01	0.94093572	0.94093572	0.26844825	0.26844825	0.26844825	0.144976	0.144976	0.144976	0.04761148	0.04761148
ETHAN-01	0.02491067	0.02491067	0.52317407	0.52317407	0.52317407	0.517717	0.517717	0.517717	0.48283057	0.48283057
PROPA-01	0.000478	0.000478	0.1510593	0.1510593	0.1510593	0.243768	0.243768	0.243768	0.28420943	0.28420943
ISOBU-01	3.26E-06	3.26E-06	0.01268876	0.01268876	0.01268876	0.036363	0.036363	0.036363	0.06480774	0.06480774
N-BUT-01	8.49E-07	8.49E-07	0.00781298	0.00781298	0.00781298	0.027692	0.027692	0.027692	0.05891294	0.05891294
2-MET-01	3.49E-09	3.49E-09	0.00058239	0.00058239	0.00058239	0.004494	0.004494	0.004494	0.01794849	0.01794849
N-PEN-01	1.03E-09	1.03E-09	0.00026984	0.00026984	0.00026984	0.002462	0.002462	0.002462	0.01156547	0.01156547
N-HEX-01	1.42E-12	1.42E-12	1.48E-05	1.48E-05	1.48E-05	0.000534	0.000534	0.000534	0.00822821	0.00822821
N-HEP-01	4.13E-15	4.13E-15	9.60E-07	9.60E-07	9.60E-07	0.000105	0.000105	0.000105	0.00433707	0.00433707
N-OCT-01	0	0	0	0	0	0	0	0	0	0
CARBO-01	0.00398399	0.00398399	0.03567473	0.03567473	0.03567473	0.021681	0.021681	0.021681	0.01954856	0.01954856
PROPY-01	0	0	0	0	0	0	0	0	0	0

Table B1 (Continued) Stream results from simulation

	S70317	S70318	S70318-1	S70319	S70320	S70321	S70322	S70323	S70323-1	S70324
Temperature K	271.14474	275.894726	275.905822	280.14273	280.33697	277.381001	278.949835	278.95039	278.95039	240.4023
Pressure barg	15	15.0925641	15.2	15	15	15.095	30.4	30.1	30.1	15
Vapor Frac	0.1102997	0	0	0.07292289	0.07663882	0	0	0	0	0.248791
Mole Flow mol/sec	910	800	800	800	800	783.155476	783.155476	783.155476	26.8178	382.6099
Mole Flow MMscmh	0.00809897			0.00470726	0.00494712					0.007681
Mass Flow kg/sec	35.6169641	32.5623139	32.5623139	32.5623139	32.5623139	32.0296049	32.0296049	32.0296049	1.09679823	14.93328
Volume Flow cum/hr	651.564554	232.404282	232.411792	468.203176	480.305033	228.993861	230.054765	230.055144	7.87783913	465.4654
Enthalpy MMkcal/hr	-93.731221	-83.741391	-83.740619	-82.91088	-82.869524	-81.986818	-81.878266	-81.878129	-2.8037744	-39.5904
Mole Frac										
NITRO-01	9.09E-09	1.16E-10	1.16E-10	1.16E-10	1.16E-10	7.99E-11	7.99E-11	7.99E-11	7.99E-11	0.003044
METHA-01	0.04761148	0.01905546	0.01905546	0.01905546	0.01905546	0.01673418	0.01673418	0.01673418	0.01673418	0.290471
ETHAN-01	0.48283057	0.46276088	0.46276088	0.46276088	0.46276088	0.45845767	0.45845767	0.45845767	0.45845767	0.180707
PROPA-01	0.28420943	0.31330915	0.31330915	0.31330915	0.31330915	0.31706908	0.31706908	0.31706908	0.31706908	0.245677
ISOBU-01	0.06480774	0.07401031	0.07401031	0.07401031	0.07401031	0.07531724	0.07531724	0.07531724	0.07531724	0.092428
N-BUT-01	0.05891294	0.06759045	0.06759045	0.06759045	0.06759045	0.06883574	0.06883574	0.06883574	0.06883574	0.093707
2-MET-01	0.01794849	0.02079852	0.02079852	0.02079852	0.02079852	0.02121675	0.02121675	0.02121675	0.02121675	0.035698
N-PEN-01	0.01156547	0.01341823	0.01341823	0.01341823	0.01341823	0.01369086	0.01369086	0.01369086	0.01369086	0.02378
N-HEX-01	0.00822821	0.00958652	0.00958652	0.00958652	0.00958652	0.00978855	0.00978855	0.00978855	0.00978855	0.019108
N-HEP-01	0.00433707	0.0050574	0.0050574	0.0050574	0.0050574	0.00516482	0.00516482	0.00516482	0.00516482	0.010389
N-OCT-01	0	0	0	0	0	0	0	0	0	0
CARBO-01	0.01954856	0.01441306	0.01441306	0.01441306	0.01441306	0.01372505	0.01372505	0.01372505	0.01372505	0.004989
PROPY-01	0	0	0	0	0	0	0	0	0	0

Table B1 (Continued) Stream results from simulation

	S70325	S70326	S70327	S70328	S70401	S70404	S70406	S70407	S70408	S70409
Temperature K	215.5953	180.234538	250.008636	286.44713	317.34881	271.080374	358.827889	353.089474	371.992161	319.394569
Pressure barg	15	15	14.6	10.7	29.9	27.51313	28.1468826	24.7	24.7	15.56215
Vapor Frac	0.266642	0.3212048	0.21894101	1	0.09717723	0	0	0.10357314	0.9058028	1
Mole Flow mol/sec	265.9241	702.319545	340.776292	340.776292	783.155476	340.776292	442.37854	442.37854	442.37854	753.105807
Mole Flow MMscmh	0.005721	0.0182025	0.00602019	0.02749689	0.00614082			0.00369705	0.0323327	0.06076735
Mass Flow kg/sec	8.589059	16.4128911	10.2130325	10.2130325	32.0296049	10.2130325	21.81654	21.81654	21.81654	32.6672833
Volume Flow cum/hr	298.2894	716.765369	345.102136	2221.42268	399.144062	91.057614	186.603637	287.600715	1178.83336	3189.79502
Enthalpy MMkcal/hr	-25.1385	-58.380084	-30.86187	-27.709399	-78.201221	-30.86187	-46.718761	-46.718761	-42.498799	-67.394745
Mole Frac										
NITRO-01	0.003687	0.00698261	1.84E-10	1.84E-10	7.99E-11	1.84E-10	4.86E-35	4.86E-35	4.86E-35	0
METHA-01	0.372364	0.62500591	0.03845769	0.03845769	0.01673418	0.03845769	8.83E-30	8.83E-30	8.83E-30	0
ETHAN-01	0.237459	0.23765751	0.93	0.93	0.45845767	0.93	0.09521638	0.09521638	0.09521638	0.05131352
PROPA-01	0.25291	0.10314482	4.68E-08	4.68E-08	0.31706908	4.68E-08	0.56131551	0.56131551	0.56131551	0.94868648
ISOBU-01	0.059932	0.01014789	2.16E-17	2.16E-17	0.07531724	2.16E-17	0.13333611	0.13333611	0.13333611	4.09E-11
N-BUT-01	0.050015	0.00641328	6.02E-19	6.02E-19	0.06883574	6.02E-19	0.12186174	0.12186174	0.12186174	6.56E-14
2-MET-01	0.009771	0.00050225	4.71E-28	4.71E-28	0.02121675	4.71E-28	0.03756058	0.03756058	0.03756058	1.96E-25
N-PEN-01	0.005478	0.00023384	4.20E-30	4.20E-30	0.01369086	4.20E-30	0.0242373	0.0242373	0.0242373	9.35E-28
N-HEX-01	0.0013	1.30E-05	2.31E-35	2.31E-35	0.00978855	2.31E-35	0.01732893	0.01732893	0.01732893	5.04E-35
N-HEP-01	0.00026	8.50E-07	2.22E-35	2.22E-35	0.00516482	2.22E-35	0.00914343	0.00914343	0.00914343	1.29E-35
N-OCT-01	0	0	0	0	0	0	0	0	0	0
CARBO-01	0.006822	0.00989799	0.03154225	0.03154225	0.01372505	0.03154225	2.87E-17	2.87E-17	2.87E-17	0
PROPY-01	0	0	0	0	0	0	0	0	0	0

Table B1 (Continued) Stream results from simulation

	S70409-1	S70410	S70411	S70411-1	S70412	S70413	S70415	S70415P	S70416	S70417
Temperature K	313.09254		313.09254	313.300979	295.31177	295.31177	338.723725	292.07	437.736005	317.81069
Pressure barg	15.56215	15.06215	15.06215	16.5	16	16	15.8302796	16	16.091706	16.091706
Vapor Frac	0		0	0	0	0	0	0	0	0
Mole Flow mol/sec	753.105807	0	753.105807	753.105807	753.105807	152.145807	254.236	254.236	35.9967333	35.9967333
Mole Flow MMscmh										
Mass Flow kg/sec	32.6672833	0	32.6672833	32.6672833	32.6672833	6.59959084	12.8003133	12.8003133	2.8181257	2.8181257
Volume Flow cum/hr	254.078174	0	254.078174	254.2867	238.578413	48.1986792	98.9285604	85.7813651	22.0929339	16.4272696
Enthalpy MMkcal/hr	-76.107065		-76.104545	-76.09334	-77.578269	-15.672709	-28.147193	-29.575751	-4.8538915	-5.6591589
Mole Frac										
NITRO-01	0	0	0	0	0	0	0	0	0	0
METHA-01	0	0	0	0	0	0	0	0	0	0
ETHAN-01	0.05131352	0	0.05131352	0.05131352	0.05131352	0.05131352	0.02238265	0.02238265	5.68E-17	5.68E-17
PROPA-01	0.94868648	0	0.94868648	0.94868648	0.94868648	0.94868648	0.52156131	0.52156131	1.55E-10	1.55E-10
ISOBU-01	4.09E-11	0	4.09E-11	4.09E-11	4.09E-11	4.09E-11	0.23200896	0.23200896	4.01E-06	4.01E-06
N-BUT-01	6.56E-14	0	6.56E-14	6.56E-14	6.56E-14	6.56E-14	0.21203089	0.21203089	9.06E-05	9.06E-05
2-MET-01	1.96E-25	0	0	0	0	0	0.0106741	0.0106741	0.38620253	0.38620253
N-PEN-01	9.35E-28	0	0	0	0	0	0.00134206	0.00134206	0.28837858	0.28837858
N-HEX-01	5.04E-35	0	0	0	0	0	1.30E-08	1.30E-08	0.21295876	0.21295876
N-HEP-01	1.29E-35	0	0	0	0	0	6.82E-13	6.82E-13	0.11236549	0.11236549
N-OCT-01	0	0	0	0	0	0	0	0	0	0
CARBO-01	0	0	0	0	0	0	0	0	0	0
PROPY-01	0	0	0	0	0	0	0	0	0	0

Table B1 (Continued) Stream results from simulation

	S70418P	S70419	S70420	S70420-1	S70422	S70422-1	S70423	S70601	S70602	S70602-1
Temperature K	299.992672	313.63338	295.31177	295.31177	278.95039	314.7259	314.688886	306.395091	398.751269	398.751392
Pressure barg	16.091706	30.1	16	16	30.1	29.9	29.9	17.9	45	45
Vapor Frac	0	0	0	0	0	0.0271156	0.0261729	1	1	1
Mole Flow mol/sec	35.9967333	26.8178	600.96	600.96	756.337676	756.337676	783.155476	3651.13792	3651.13792	2901.13792
Mole Flow MMscmh						0.00165481	0.00165391	0.29460668	0.29460668	0.23408993
Mass Flow kg/sec	2.8181257	1.09679823	26.4691991	26.0676925	30.9328067	30.9328067	32.0296049	61.6040553	61.6040553	48.9496329
Volume Flow cum/hr	15.9635134	8.92138081	191.433709	190.379734	222.177305	288.91862	297.819768	17033.9154	9195.71361	7306.77489
Enthalpy MMkcal/hr	-5.7563188	-2.7066145	-62.564198	-61.90556	-79.074355	-76.103163	-78.809778	-231.89063	-221.25341	-175.80455
Mole Frac										
NITRO-01	0	7.99E-11	0	0	7.99E-11	7.99E-11	7.99E-11	0.02968749	0.02968749	0.02968749
METHA-01	0	0.01673418	0	0	0.01673418	0.01673418	0.01673418	0.94093572	0.94093572	0.94093572
ETHAN-01	5.68E-17	0.45845767	0.00368293	0.05131352	0.45845767	0.45845767	0.45845767	0.02491067	0.02491067	0.02491067
PROPA-01	1.55E-10	0.31706908	0.99631707	0.94868648	0.31706908	0.31706908	0.31706908	0.000478	0.000478	0.000478
ISOBU-01	4.01E-06	0.07531724	2.11E-11	4.09E-11	0.07531724	0.07531724	0.07531724	3.26E-06	3.26E-06	3.26E-06
N-BUT-01	9.06E-05	0.06883574	3.15E-14	6.56E-14	0.06883574	0.06883574	0.06883574	8.49E-07	8.49E-07	8.49E-07
2-MET-01	0.38620253	0.02121675	0	0	0.02121675	0.02121675	0.02121675	3.49E-09	3.49E-09	3.49E-09
N-PEN-01	0.28837858	0.01369086	0	0	0.01369086	0.01369086	0.01369086	1.03E-09	1.03E-09	1.03E-09
N-HEX-01	0.21295876	0.00978855	0	0	0.00978855	0.00978855	0.00978855	1.42E-12	1.42E-12	1.42E-12
N-HEP-01	0.11236549	0.00516482	0	0	0.00516482	0.00516482	0.00516482	4.13E-15	4.13E-15	4.13E-15
N-OCT-01	0	0	0	0	0	0	0	0	0	0
CARBO-01	0	0.01372505	0	0	0.01372505	0.01372505	0.01372505	0.00398399	0.00398399	0.00398399
PROPY-01	0	0	0	0	0	0	0	0	0	0

Table B1 (Continued) Stream results from simulation

	S70602-2	S70603	S70603-1	S70603-2	S70603-3	S70603M	S70604	S70605	S70606	S70607
Temperature K	398.751392	358.306	366.613483	366.613483	299.5	366.613483	301.011865	366.613483	284.325619	366.613483
Pressure barg	45	42.77252	42.77252	42.77252	42.77251	42.77252	42.77251	42.77252	42.77252	42.77252
Vapor Frac	1	1	1	1	1	1	1	1	1	1
Mole Flow mol/sec	750	2901.13792	3636.95792	3296.25792	3296.25792	3651.13792	3651.13792	14.18	14.18	340.7
Mole Flow MMscmh	0.06051675	0.23408993	0.29346251	0.26597177	0.26597177	0.29460668	0.29460668	0.00114417	0.00114417	0.02749074
Mass Flow kg/sec	12.6544224	48.9496329	61.3648023	55.61632	55.61632	61.6040553	61.6040553	0.23925295	0.23925295	5.74848228
Volume Flow cum/hr	1888.94197	6785.17651	8741.38128	7922.51324	6141.55802	8775.46273	6849.29929	34.0814465	24.5756382	818.868041
Enthalpy MMkcal/hr	-45.44886	-180.02451	-224.5977	-203.55801	-211.40185	-225.47337	-233.96712	-0.8756756	-0.9170307	-21.039681
Mole Frac										
NITRO-01	0.02968749	0.02968749	0.02968749	0.02968749	0.02968749	0.02968749	0.02968749	0.02968749	0.02968749	0.02968749
METHA-01	0.94093572	0.94093572	0.94093572	0.94093572	0.94093572	0.94093572	0.94093572	0.94093572	0.94093572	0.94093572
ETHAN-01	0.02491067	0.02491067	0.02491067	0.02491067	0.02491067	0.02491067	0.02491067	0.02491067	0.02491067	0.02491067
PROPA-01	0.000478	0.000478	0.000478	0.000478	0.000478	0.000478	0.000478	0.000478	0.000478	0.000478
ISOBU-01	3.26E-06	3.26E-06	3.26E-06	3.26E-06	3.26E-06	3.26E-06	3.26E-06	3.26E-06	3.26E-06	3.26E-06
N-BUT-01	8.49E-07	8.49E-07	8.49E-07	8.49E-07	8.49E-07	8.49E-07	8.49E-07	8.49E-07	8.49E-07	8.49E-07
2-MET-01	3.49E-09	3.49E-09	3.49E-09	3.49E-09	3.49E-09	3.49E-09	3.49E-09	3.49E-09	3.49E-09	3.49E-09
N-PEN-01	1.03E-09	1.03E-09	1.03E-09	1.03E-09	1.03E-09	1.03E-09	1.03E-09	1.03E-09	1.03E-09	1.03E-09
N-HEX-01	1.42E-12	1.42E-12	1.42E-12	1.42E-12	1.42E-12	1.42E-12	1.42E-12	1.42E-12	1.42E-12	1.42E-12
N-HEP-01	4.13E-15	4.13E-15	4.13E-15	4.13E-15	4.13E-15	4.13E-15	4.13E-15	4.13E-15	4.13E-15	4.13E-15
N-OCT-01	0	0	0	0	0	0	0	0	0	0
CARBO-01	0.00398399	0.00398399	0.00398399	0.00398399	0.00398399	0.00398399	0.00398399	0.00398399	0.00398399	0.00398399
PROPY-01	0	0	0	0	0	0	0	0	0	0

Table B1 (Continued) Stream results from simulation

	S70608	S70608-1
Temperature K	316.354212	315.071584
Pressure barg	42.77252	42.77252
Vapor Frac	1	1
Mole Flow mol/sec	340.7	354.88
Mole Flow MMscmh	0.02749074	0.02863491
Mass Flow kg/sec	5.74848228	5.98773523
Volume Flow cum/hr	682.563019	707.231727
Enthalpy MMkcal/hr	-21.648238	-22.565268
Mole Frac		
NITRO-01	0.02968749	0.02968749
METHA-01	0.94093572	0.94093572
ETHAN-01	0.02491067	0.02491067
PROPA-01	0.000478	0.000478
ISOBU-01	3.26E-06	3.26E-06
N-BUT-01	8.49E-07	8.49E-07
2-MET-01	3.49E-09	3.49E-09
N-PEN-01	1.03E-09	1.03E-09
N-HEX-01	1.42E-12	1.42E-12
N-HEP-01	4.13E-15	4.13E-15
N-OCT-01	0	0
CARBO-01	0.00398399	0.00398399
PROPY-01	0	0

Appendix C Retrofit alternative pictures.

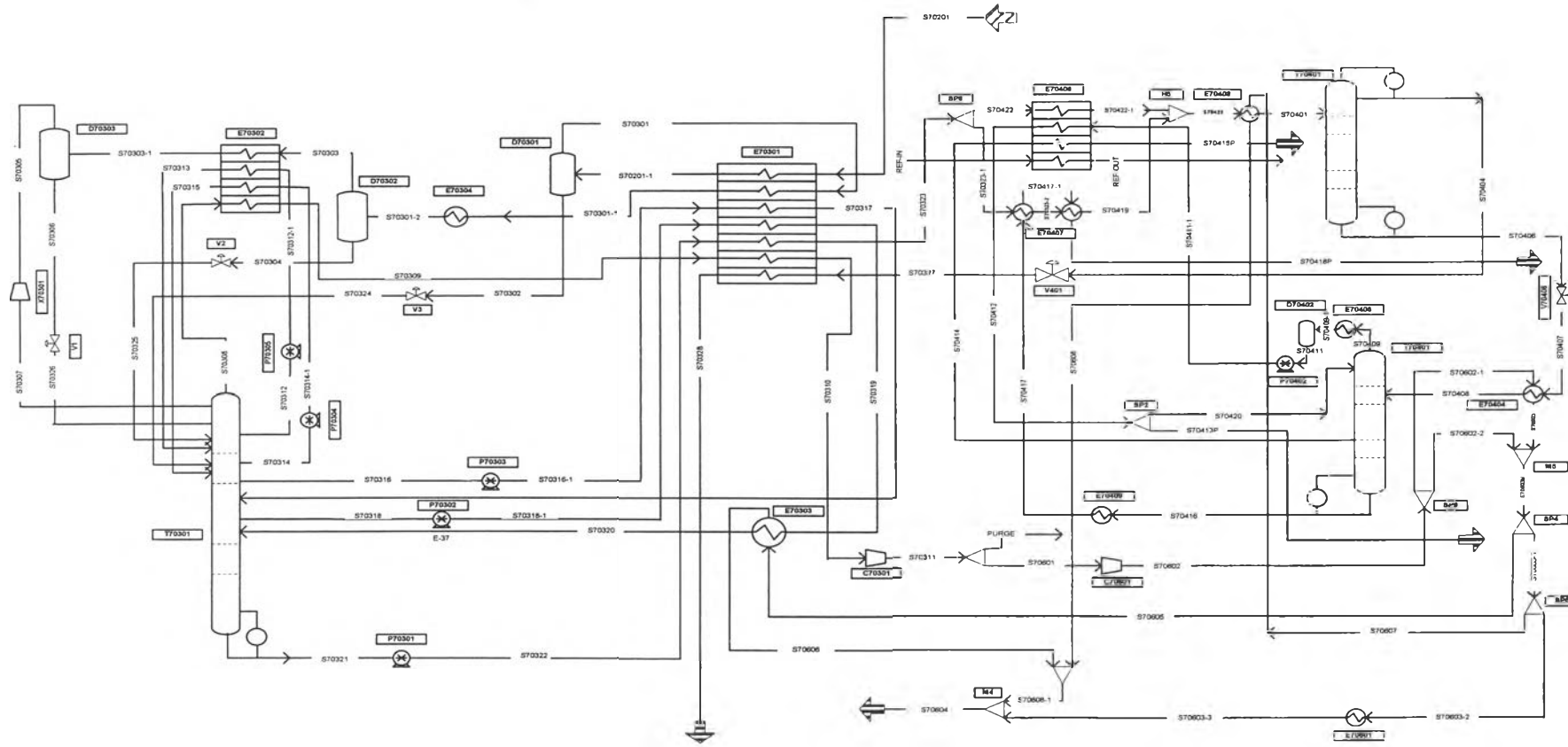


Figure C1 Existing Plant

Added Heat Exchanger

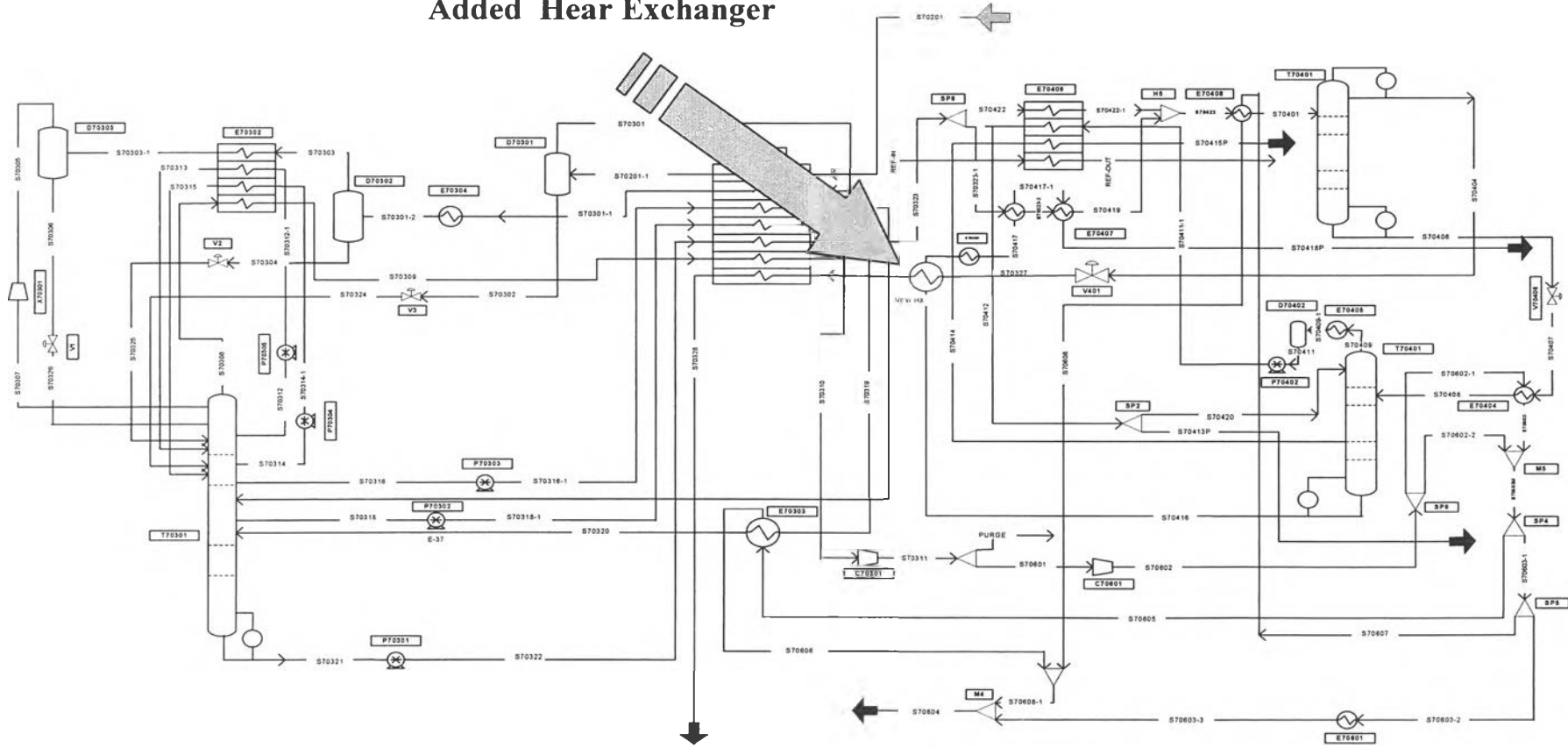


Figure C2 Alternative 1.

Modified Depropanizer Condenser

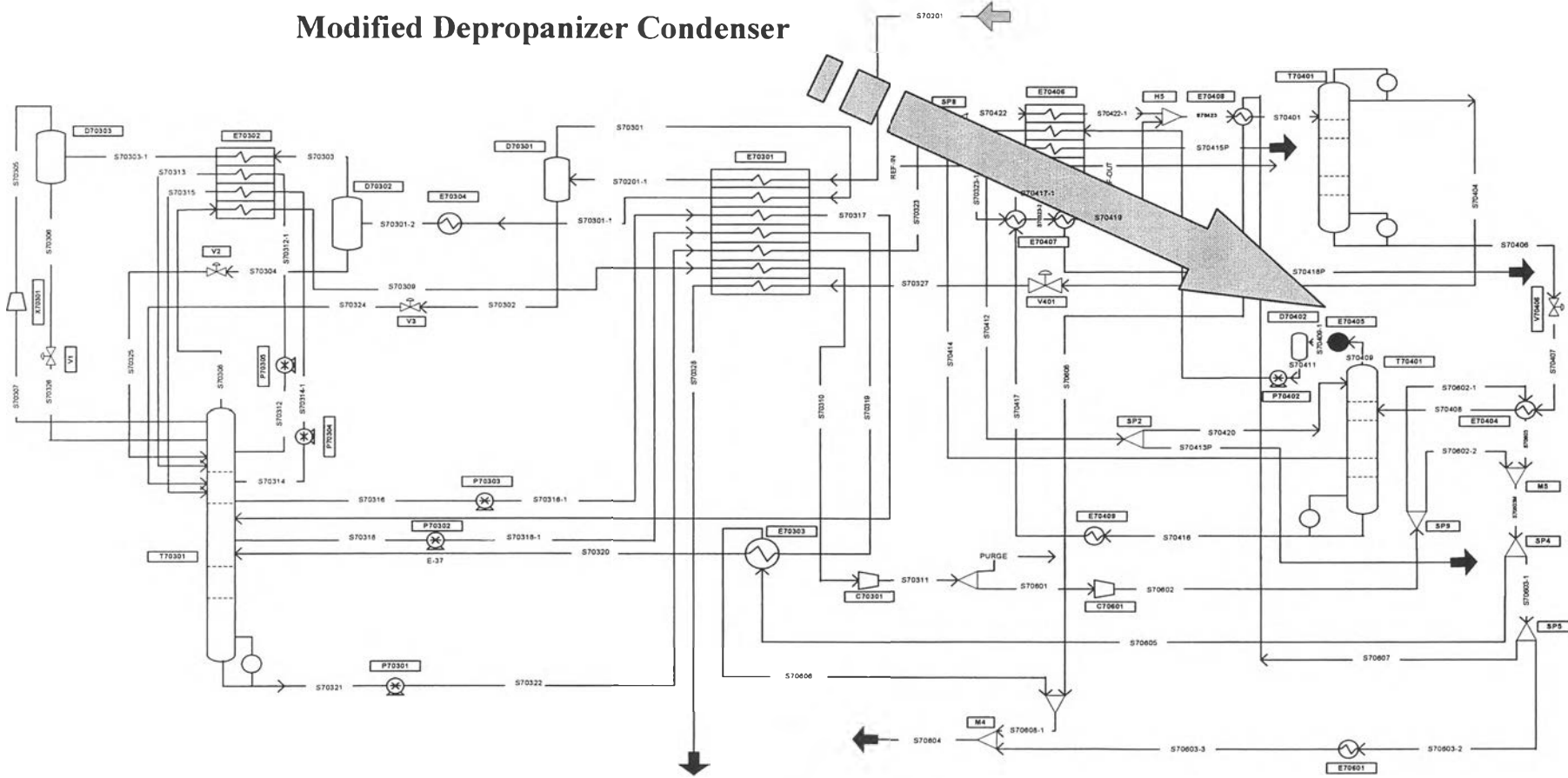


Figure C3 Alternative 2.

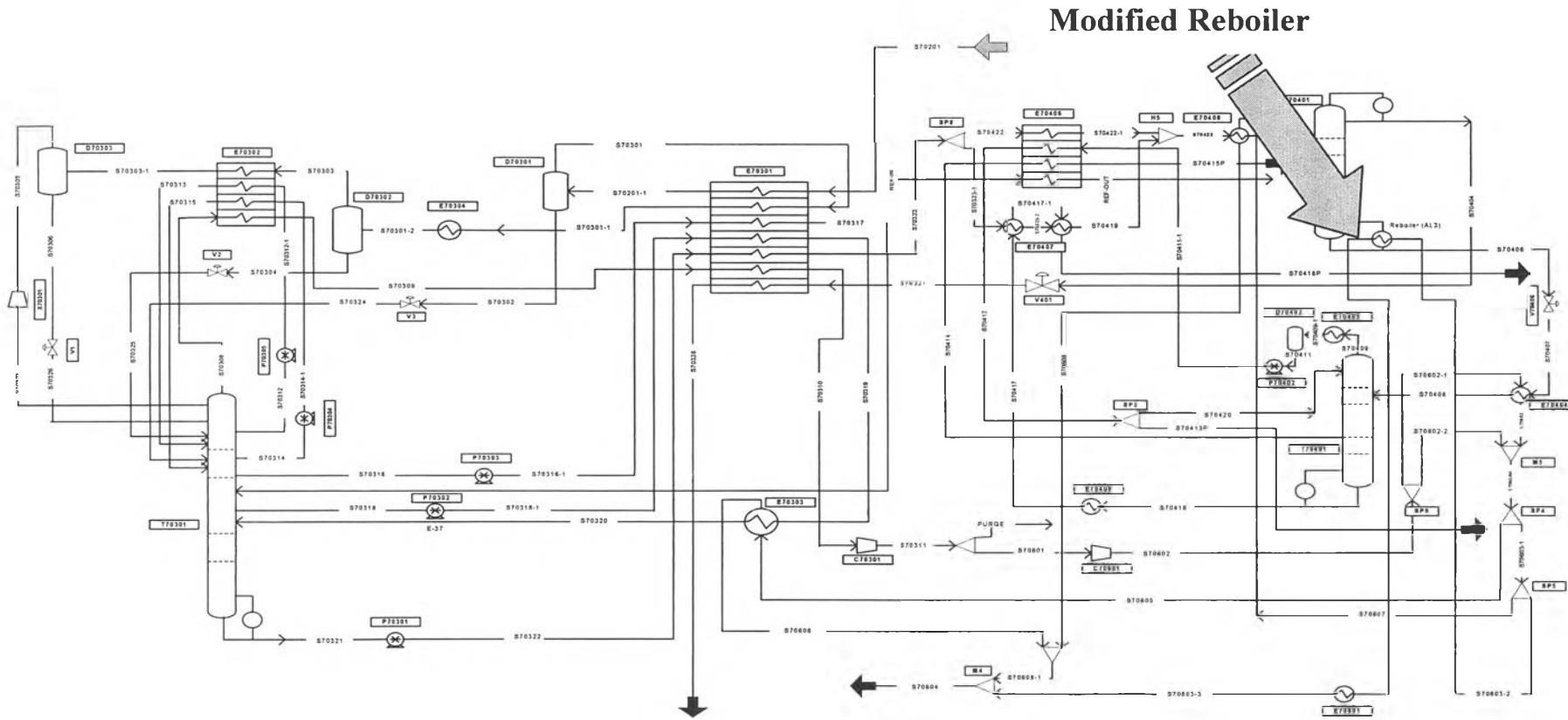


Figure C4 Alternative 3.

Components	Assumed % of total	Cost
Purchased equipment	27.5	16,000
Purchased-equipment installation	10	5,818.182
Instrumentation (installed)	5	2,909.091
Piping (installed)	11.5	6,690.909
Electrical (installed)	6	3,490.909
Building (including services)	10.5	6,109.091
Yard improvements	3.5	2,036.364
Service facilities (installed)	14	8,145.455
Land	1.5	872.7273
Engineering and supervision	12.5	7,272.727
Construction expense	10	5,818.182
Contractor's fee	4	2,327.273
Contingency	10	5,818.182
TOTAL CAPITAL COST		73,309.09

Pay back period = 0.683 year

Alternative 2

At depropanizer condenser, from measured data the temperature of line number was 313.1 K but the design temperature of this line would be 319.982 therefore condenser duty of depropanizer should be 9150.343 kw from 10132.28 kw. The Energy could be reduced 981.937 kw.

Plant approximately operates 11 months or 28512000 sec

Plant saves 981.937 kw or 2.799×10^{10} kJ/year or 7775000 kw-h

Cooling water cost = 0.16 baht/kw*hr

$$= 1,244,000 \text{ bahts / year}$$

Flow rate of water is $(10132.28 \times 3600) / (4.18 \times 10) = 872,636.555 \text{ kg/hr}$

$$\text{Design rate} = 788,067 \text{ kg/hr}$$

UA design = 1,536 kw/m²K

UA existing must be equaled to UA design

So Depropanizer duty must be 9,150.343 kw

Alternative 3

From column and process integration, it is found that in deethanizer reboiler there was some scope of integration with process. If we add new exchanger between line s70603-2 and deethanizer, it would save energy both steam at reboiler and cooling water at E70601 around 6197.782 kw.

Plant approximately operates 11 months or 28512000 sec

Plant saves 6,197.782 kw or 17.671×10^{10} kJ/year or 49086433.44 kw-h

Cooling water cost = 0.16 baht/kw*hr

$$= 7,853,829.3504 \text{ bahts / year}$$

Utility at deethanizer is reduced 17.671×10^{10} kJ/year

Latent heat of steam at $T = 416.15$ K or 4 bar is 2,132.95 kJ/kg

The amount of saved steam is 82,847.7 ton

Cost of steam is 6.5 \$/ ton

Saved steam is 19,924,871.85 baths / year

Total saved money = cooling water cost + steam cost = 7,853,829.35 + 19,924,871.85
= 27,778,701.2 baths/year

Heat exchanger area calculation

Hot stream; Temp in = 366.6 K Temp out = 321.01 K

Cold stream; Temp in = 313.2 K Temp out = 338.5 K

ΔT_{im} is 15.84705 K

$Q = 6,197.782$ kw

$UA = 391.1$ kw/K

If $U = 670$ w/m²K

$A = 583.73134$ m² or 6283.231851 ft²

Type of exchanger is shell and tube (carbon steel)

Pressure is 42.773 barg or 634.873716psi

Heat Exchanger cost (year 2003) is 118,700 \$ or 4,748,000 baths

(COST REFERENCE <http://matche.com/EquipCost/Exchanger.htm>)

Saved cost = 27,778,701.2 baths/year

Table D2. Percent of capital investment for direct and indirect cost segments on existing facilities

Components	Assumed % of total	Cost
Purchased equipment	27.5	4,748,000
Purchased-equipment installation	10	1,726,545.455
Instrumentation (installed)	5	863,272.7273
Piping (installed)	11.5	1,985,527.273
Electrical (installed)	6	1,035,927.273
Building (including services)	10.5	1,812,872.727
Yard improvements	3.5	604,290.9091
Service facilities (installed)	14	2,417,163.636
Land	1.5	258,981.8182
Engineering and supervision	12.5	2,158,181.818
Construction expense	10	1,726,545.455
Contractor's fee	4	690,618.1818
Contingency	10	1,726,545.455
TOTAL CAPITAL COST		21,754,472.73

Pay back period = 0.783 year

Alternative 4

Pressure (barg)	13 bar	13.5 bar	14 bar	14.5 bar	15 bar	15.562 bar	16 bar	16.5 bar	17 bar	17.5 bar	18 bar	18.5 bar	19 bar
Condenser(Kw)	11805.78	11673.54	11541.64	11410.01	11278.508	11130.75	11015.72	10884.34	10752.77	10621	10488.95	10356.55	10223.73
Reboiler(Kw)	6386.858	6464.741	6539.718	6611.954	6681.4415	6756.513	6812.903	6875.06	6934.93	6992.584	7048.082	7101.482	7152.833
total time(sec)	28512000	28512000	28512000	28512000	28512000	28512000	28512000	28512000	28512000	28512000	28512000	28512000	28512000
Cond (kj/year)	3.37E+11	3.33E+11	3.29E+11	3.25E+11	3.216E+11	3.17E+11	3.14E+11	3.1E+11	3.07E+11	3.03E+11	2.99E+11	2.95E+11	2.91E+11
Cond (kw*hr)	93501760	92454419	91409814	90367258	89325785	88155521	87244540	86203955	85161961	84118337	83072490	82023872	80971957
watercost(bath/kw*hr)	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
total water cost	14960282	14792707	14625570	14458761	14292126	14104883	13959126	13792633	13625914	13458934	13291598	13123820	12955513
Reboil (kj/year)	1.82E+11	1.84E+11	1.86E+11	1.89E+11	1.905E+11	1.93E+11	1.94E+11	1.96E+11	1.98E+11	1.99E+11	2.01E+11	2.02E+11	2.04E+11
Steam Latent heat(kj/kg)	1921.55	1921.55	1921.55	1921.55	1921.55	1921.55	1921.55	1921.55	1921.55	1921.55	1921.55	1921.55	1921.55
steam rate(ton)	94768.33	95923.97	97036.48	98108.31	99139.372	100253.3	101090	102012.3	102900.6	103756.1	104579.6	105371.9	106133.9
steam cost(bath/ton)	260	260	260	260	260	260	260	260	260	260	260	260	260
total steam cost	24639766	24940232	25229484	25508161	25776237	26065852	26283399	26523193	26754166	26976589	27190695	27396705	27594810
TOTAL (water+steam)	39600048	39732939	39855054	39966923	40068362	40170735	40242526	40315826	40380080	40435523	40482294	40520524	40550323

Appendix E DATACON keywords and results.

\$ Generated by DATACON Keyword Generation System <version 2.22 - 08-21-96>

\$ Generated on: Fri Feb 20 16:24:51 2004

TITLE PROJECT=MANUAL, PROBLEM=AMMONIA, USER=SIMSCI STAFF,

DATE=MAY 94

DESCRIPTION NH3 SYNTHESIS

DESCRIPTION TOTAL PLANT

DIMENSION SI, PRES=BARG, WT=G, TIME=SEC, DUTY=WATT,

STDTEMP=273.15, &

STDPRES=0

PRINT ERRA=ALL

CALC NITR=10, CBAS=M

TOLE CDEV=0.0001,0/0.0001,0.002/0.005,0.1/ &

0.025,1, RDEV=-0.03, TDEV=0.55556

COMPONENT DATA

LIBID 1,N2/2,METHANE/3,ETHANE/4,PROPANE/5,IBUTANE/6,BUTANE/ &

7,IPENTANE/8,PENTANE/9,HEXANE/10,HEPTANE/11,CO2/12,PROPENE

THERMODYNAMIC DATA

METHOD SYSTEM=SRK, SET=SRK01

STREAM DATA

PROPERTY STREAM=S70201, TEMPERATURE(K)=#TS201#, &

PRESSURE(BARG)=##PS201##, RATE(M,G/S)=#FS201#, &

COMPOSITION(M)=1,#N2S2201#/2,#MES201#/3,#ETS201#/ &

4,#PRS70201#/5,#IBUS201#/6,#NBUS201#/7,#IPENS201#/ &

8,#NPENS201#/9,#HEXS201#/10,#HEPS201#/11,#CARS201#, &

NORMALIZE, PHASE=M

PROPERTY STREAM=S70201-1, PRESSURE(BARG)=#PS201-1#, PHASE=M

PROPERTY STREAM=S70301, TEMPERATURE(K)=271.5,

PRESSURE(BARG)=43.1, &

COMPOSITION(M)=1,0.016/2,0.809/3,0.101/4,0.048/5,0.01/ &

6,0.008/7,0.001/8,0.002/9,0.000353/10,8.3E-5/11,0.004, &

PHASE=M

PROPERTY STREAM=S70302, TEMPERATURE(K)=271.5,
PRESSURE(BARG)=43.1, &

COMPOSITION(M)=1,0.002/2,0.243/3,0.151/4,0.218/5,0.103/ &

6,0.112/7,0.036/8,0.062/9,0.044/10,0.027/11,0.003, PHASE=M

PROPERTY STREAM=S70301-1, TEMPERATURE(K)=#TS301-1#, &

PRESSURE(BARG)=43.1, PHASE=M

PROPERTY STREAM=S70301-2, TEMPERATURE(K)=236.2,

PRESSURE(BARG)=43.1, &

PHASE=M

PROPERTY STREAM=S70303, TEMPERATURE(K)=#TS303#,

PRESSURE(BARG)=37.8, &

COMPOSITION(M)=1,0.018/2,0.864/3,0.086/4,0.024/5,0.002/ &

6,0.002/7,9.8E-5/8,0.000115/9,6E-6/10,4.42E-8/11,0.004, &

PHASE=M

PROPERTY STREAM=S70304, TEMPERATURE(K)=236.2,

PRESSURE(BARG)=37.8, &

COMPOSITION(M)=1,0.002/2,0.339/3,0.233/4,0.256/5,0.072/ &

6,0.064/7,0.01/8,0.015/9,0.003/10,0.000799/11,0.004, PHASE=M

PROPERTY STREAM=S70303-1, PRESSURE(BARG)=37.8, PHASE=M

PROPERTY STREAM=S70305, TEMPERATURE(K)=#TS305#, &

PRESSURE(BARG)=#PS305#, COMPOSITION(M)=1,0.021/2,0.919/ &

3,0.051/4,0.005/5,0.000209/6,9.9E-5/7,2E-6/8,2E-6/9,2.4E-8/ &

11,0.003, PHASE=M

PROPERTY STREAM=S70306, TEMPERATURE(K)=206.2,

PRESSURE(BARG)=37.736, &

COMPOSITION(M)=1,0.004/2,0.601/3,0.253/4,0.113/5,0.013/ &

6,0.009/7,0.000551/8,0.000651/9,3.3E-5/10,3E-6/11,0.007, &

PHASE=M

PROPERTY STREAM=S70308, TEMPERATURE(K)=#TS308#,
 PRESSURE(BARG)=15.4, &
 COMPOSITION(M)=1,0.019/2,0.949/3,0.028/4,0.000595/5,5E-6/ &
 6,1E-6/7,5E-10/8,3E-10/11,0.003, PHASE=M
 PROPERTY STREAM=S70321, TEMPERATURE(K)=#TS321#, &
 PRESSURE(BARG)=15.401, RATE(M,G/S)=#F321-1#, &
 COMPOSITION(M)=2,0.016/3,0.473/4,0.315/5,0.074/6,0.066/ &
 7,0.013/8,0.02/9,0.01/10,0.005/11,0.009, NORMALIZE, PHASE=M
 PROPERTY STREAM=S70312, TEMPERATURE(K)=201.4,
 PRESSURE(BARG)=15.4, &
 COMPOSITION(M)=1,0.000153/2,0.28/3,0.508/4,0.167/5,0.016/ &
 6,0.011/7,0.000654/8,0.000768/9,3.8E-5/10,3E-6/11,0.017, &
 PHASE=M
 PROPERTY STREAM=S70313, TEMPERATURE(K)=#TS313#,
 PRESSURE(BARG)=15.4, &
 COMPOSITION(M)=1,0.000153/2,0.28/3,0.508/4,0.167/5,0.016/ &
 6,0.011/7,0.000654/8,0.000768/9,3.8E-5/10,3E-6/11,0.017, &
 PHASE=M
 PROPERTY STREAM=S70314, TEMPERATURE(K)=#TS314-1#, &
 PRESSURE(BARG)=15.4, RATE(M,G/S)=#FS314#, COMPOSITION(M)=1,
 &
 5.9E-5/2,0.148/3,0.47/4,0.259/5,0.051/6,0.043/7,0.006/8,0.009/ &
 9,0.002/10,0.000436/11,0.012, NORMALIZE, PHASE=M
 PROPERTY STREAM=S70315, TEMPERATURE(K)=#TS315#,
 PRESSURE(BARG)=15.4, &
 COMPOSITION(M)=1,5.9E-5/2,0.148/3,0.47/4,0.259/5,0.051/ &
 6,0.043/7,0.006/8,0.009/9,0.002/10,0.000436/11,0.012, PHASE=M
 PROPERTY STREAM=S70316, TEMPERATURE(K)=#TS316-1#, &
 PRESSURE(BARG)=15.401, COMPOSITION(M)=1,8E-10/2,0.054/ &
 3,0.498/4,0.277/5,0.062/6,0.056/7,0.011/8,0.017/9,0.008/ &
 10,0.004/11,0.013, PHASE=M

PROPERTY STREAM=S70317, TEMPERATURE(K)=270.7,
PRESSURE(BARG)=15.4, &
COMPOSITION(M)=1,8E-10/2,0.054/3,0.498/4,0.277/5,0.062/ &
6,0.056/7,0.011/8,0.017/9,0.008/10,0.004/11,0.013, PHASE=M
PROPERTY STREAM=S70318, TEMPERATURE(K)=#TS318-1#, &
PRESSURE(BARG)=15.401, RATE(M,G/S)=#FS318-1#, &
COMPOSITION(M)=2,0.02/3,0.482/4,0.307/5,0.071/6,0.064/ &
7,0.012/8,0.019/9,0.009/10,0.005/11,0.01, NORMALIZE, PHASE=M
PROPERTY STREAM=S70319, TEMPERATURE(K)=#TS319#,
PRESSURE(BARG)=15.4, &
COMPOSITION(M)=2,0.02/3,0.482/4,0.307/5,0.071/6,0.064/ &
7,0.012/8,0.019/9,0.009/10,0.005/11,0.01, PHASE=M
PROPERTY STREAM=S70309, TEMPERATURE(K)=#TS309#,
PRESSURE(BARG)=15.2, &
PHASE=M
PROPERTY STREAM=S70323, TEMPERATURE(K)=#TS323#,
PRESSURE(BARG)=30.1, &
PHASE=M
PROPERTY STREAM=S70310, TEMPERATURE(K)=284.05, &
PRESSURE(BARG)=#PS310-2#, RATE(M,G/S)=#FS311#, &
COMPOSITION(M)=1,0.03/2,0.941/3,0.025/4,0.000478/5,3E-6/ &
6,8.49E-7/7,3E-9/8,1E-9/11,0.004, NORMALIZE, PHASE=M
PROPERTY STREAM=S70422, PRESSURE(BARG)=30.1,
RATE(M,G/S)=698.72, &
PHASE=M
PROPERTY STREAM=S70323-1, PRESSURE(BARG)=30.1,
RATE(M,G/S)=33.118, &
PHASE=M
PROPERTY STREAM=S70422-1, PRESSURE(BARG)=29.9, PHASE=M
PROPERTY STREAM=S70419, PRESSURE(BARG)=30.009, PHASE=M
PROPERTY STREAM=S70423, PRESSURE(BARG)=29.9, PHASE=M

PROPERTY STREAM=S70401, TEMPERATURE(K)=#TS401#,
 PRESSURE(BARG)=29.9, &
 PHASE=M
 PROPERTY STREAM=S70404, TEMPERATURE(K)=#TS404#, &
 PRESSURE(BARG)=#PS405#,
 COMPOSITION(M)=1,#NIS404#/2,#MES404#/ &
 3,#ETS404#/4,#PRS404#/11,#CARS404#, NORMALIZE, PHASE=M
 PROPERTY STREAM=S70406, TEMPERATURE(K)=#TS406#, &
 PRESSURE(BARG)=27.639, COMPOSITION(M)=3,0.000999/4,0.626/ &
 5,0.146/6,0.132/7,0.026/8,0.04/9,0.019/10,0.01, PHASE=M
 PROPERTY STREAM=S70328, TEMPERATURE(K)=#TS328#,
 PRESSURE(BARG)=10.7, &
 COMPOSITION(M)=2,0.032/3,0.95/4,3E-5/11,0.018, PHASE=M
 PROPERTY STREAM=S70408, TEMPERATURE(K)=#TS408#, &
 PRESSURE(BARG)=16.274, PHASE=M
 PROPERTY STREAM=S70409, TEMPERATURE(K)=319.9,
 PRESSURE(BARG)=15.062, &
 RATE(M,G/S)=592.578, COMPOSITION(M)=3,0.004/4,0.996, PHASE=M
 PROPERTY STREAM=S70416, TEMPERATURE(K)=#TS416#, &
 PRESSURE(BARG)=15.57, RATE(M,G/S)=#FS418#,
 COMPOSITION(M)=6, &
 #NBUS418#/7,#IPENS418#/8,#NPENS418#/9,#HEXS318#/10,#HEPS418#, &
 NORMALIZE, PHASE=M
 PROPERTY STREAM=S70409-1, PRESSURE(BARG)=15.062, PHASE=M
 PROPERTY STREAM=S70410, TEMPERATURE(K)=315.6,
 PRESSURE(BARG)=15.062, &
 COMPOSITION(M)=4,1, PHASE=M
 PROPERTY STREAM=S70411-1, TEMPERATURE(K)=315.8,
 PRESSURE(BARG)=16.5, &
 COMPOSITION(M)=3,0.004/4,0.996, PHASE=M
 PROPERTY STREAM=S70414, TEMPERATURE(K)=#TS414#, &

PRESSURE(BARG)=15.319, RATE(M,G/S)=#FS415#,
 COMPOSITION(M)=3, &
 #ETS415#/4,#PRS415#/5,#ISBS415#/6,#NBS415#/7,#IPENS415#/ &
 8,#NPENS415#/9,1E-8, NORMALIZE, PHASE=M
 PROPERTY STREAM=S70412, TEMPERATURE(K)=#TS412#,
 PRESSURE(BARG)=16.5, &
 PHASE=M
 PROPERTY STREAM=S70420, TEMPERATURE(K)=#TS420#,
 PRESSURE(BARG)=16.5, &
 RATE(M,G/S)=#FS420#, COMPOSITION(M)=3,0.004/4,0.996, &
 NORMALIZE, PHASE=M
 PROPERTY STREAM=S70413P, TEMPERATURE(K)=#TS413#, &
 PRESSURE(BARG)=16.5, RATE(M,G/S)=#FS413#, COMPOSITION(M)=2,
 &
 #MES413#/3,#ETS413#/4,#PRS413#, NORMALIZE, PHASE=M
 PROPERTY STREAM=PURGE, PRESSURE(BARG)=17.9, RATE(M,G/S)=60,
 PHASE=M
 PROPERTY STREAM=S70601, TEMPERATURE(K)=#TS601#, &
 PRESSURE(BARG)=#PS601#, RATE(M,G/S)=3584.8, PHASE=M
 PROPERTY STREAM=S70602-1, PRESSURE(BARG)=45,
 RATE(M,G/S)=3034.8, &
 PHASE=M
 PROPERTY STREAM=S70602-2, TEMPERATURE(K)=#TS602#, &
 PRESSURE(BARG)=#PS602#, RATE(M,G/S)=550, PHASE=M
 PROPERTY STREAM=S70603, TEMPERATURE(K)=#TS603#,
 PRESSURE(BARG)=43.2, &

 RATE(M,G/S)=3034.8, PHASE=M
 PROPERTY STREAM=S70603M, PRESSURE(BARG)=43.2,
 RATE(M,G/S)=3584.8, &
 PHASE=M
 PROPERTY STREAM=S70605, PRESSURE(BARG)=43.2, RATE(M,G/S)=85, &

PHASE=M
 PROPERTY STREAM=S70603-1, PRESSURE(BARG)=43.2,
 RATE(M,G/S)=3499.8, &
 PHASE=M
 PROPERTY STREAM=S70320, TEMPERATURE(K)=#TS320#,
 PRESSURE(BARG)=15.4, &
 RATE(M,G/S)=883.598, PHASE=M
 PROPERTY STREAM=S70606, TEMPERATURE(K)=#TS606#,
 PRESSURE(BARG)=43.2, &
 RATE(M,G/S)=85, PHASE=M
 PROPERTY STREAM=S70607, PRESSURE(BARG)=43.2,
 RATE(M,G/S)=39.144, &
 PHASE=M
 PROPERTY STREAM=S70603-2, PRESSURE(BARG)=#TS603-2#, &
 RATE(M,G/S)=3460.66, PHASE=M
 PROPERTY STREAM=S70603-3, PRESSURE(BARG)=43,
 RATE(M,G/S)=3460.66, &
 PHASE=M
 PROPERTY STREAM=S70608, TEMPERATURE(K)=#TS608#,
 PRESSURE(BARG)=43.2, &
 RATE(M,G/S)=39.144, PHASE=M
 PROPERTY STREAM=S70608-1, TEMPERATURE(K)=295.8,
 PRESSURE(BARG)=43.2, &
 COMPOSITION(M)=1,0.019/2,0.949/3,0.028/4,0.000595/5,5E-6/ &
 6,1E-6/7,5E-10/8,3E-10/11,0.003, PHASE=M
 PROPERTY STREAM=S70604, TEMPERATURE(K)=321.2, &
 PRESSURE(BARG)=#PS604#, RATE(M,G/S)=#FS604#, &
 COMPOSITION(M)=1,0.019/2,0.949/3,0.028/4,0.000595/5,5E-6/ &
 6,1E-6/7,5E-10/8,3E-10/11,0.003, NORMALIZE, PHASE=M
 UNIT OPERATIONS
 COLUMN UID=T70301
 FEED S70305,S70306,S70304,S70302,S70315,S70313,S70317,S70320

PRODUCT S70308,S70321,S70312,S70314,S70316,S70318
COLUMN UID=T70401
FEED S70401
PRODUCT S70404,S70406
COLUMN UID=T1
FEED S70408,S70420
PRODUCT S70409,S70416,S70414
FLASH UID=D70301, UBAL=MATL,COMP,HEAT
FEED S70201-1
PRODUCT V=S70301, L=S70302
TPSPEC TEMPERATURE(K)=#TD70301#
FLASH UID=D70302
FEED S70301-2
PRODUCT V=S70303, L=S70304
TPSPEC TEMPERATURE(K)=##TD70302##
FLASH UID=D70303
FEED S70303-1
PRODUCT V=S70305, L=S70306
TPSPEC PRESSURE=37.736
FLASH UID=D70402
FEED S70409-1
PRODUCT V=S70410, L=S70411-1
HTR UID=E70301-1, UBAL=MATL,COMP,HEAT, CBAS=M
FEED S70201
PRODUCT S70201-1
HTR UID=E70301-2
FEED S70301
PRODUCT S70301-1
HTR UID=H2
FEED S70301-1
PRODUCT S70301-2
HTR UID=E70302

FEED S70303
PRODUCT S70303-1
HTR UID=E70302-2
FEED S70312
PRODUCT S70313
HTR UID=E70302-3
FEED S70314
PRODUCT S70315
HTR UID=E70301-3
FEED S70316
PRODUCT S70317
HTR UID=E70301-4
FEED S70318
PRODUCT S70319
HTR UID=E70302-4
FEED S70308
PRODUCT S70309
HTR UID=E70301-5
FEED S70321
PRODUCT S70323
HTR UID=E70301-6
FEED S70309
PRODUCT S70310
HTR UID=E70406-1
FEED S70422
PRODUCT S70422-1
HTR UID=E70407
FEED S70323-1
PRODUCT S70419
HTR UID=E70301-7
FEED S70404
PRODUCT S70328

HTR UID=E70405

FEED S70409

PRODUCT S70409-1

HTR UID=E70406-2

FEED S70411-1

PRODUCT S70412

HTR UID=H1

FEED S70603-2

PRODUCT S70603-3

HX UID=E70408

HOT FEED=S70607, PROD=S70608

COLD FEED=S70423, PROD=S70401

HX UID=E70404

HOT FEED=S70602-1, PROD=S70603

COLD FEED=S70406, PROD=S70408

HX UID=E1

HOT FEED=S70319, PROD=S70320

COLD FEED=S70605, PROD=S70606

MIXER UID=M1

FEED S70422-1,S70419

PRODUCT S70423

MIXER UID=M5

FEED S70602-2,S70603

PRODUCT S70603M

MIXER UID=M2

FEED S70606,S70608

PRODUCT S70608-1

MIXER UID=M4

FEED S70608-1,S70603-3

PRODUCT S70604

SPLITTER UID=SP8

FEED S70323
PRODUCT S70422,S70323-1
SPLITTER UID=SP1
FEED S70412
PRODUCT S70420,S70413P
SPLITTER UID=SP2
FEED S70310
PRODUCT PURGE,S70601
SPLITTER UID=SP9
FEED S70601
PRODUCT S70602-1,S70602-2
SPLITTER UID=SP4
FEED S70603M
PRODUCT S70605,S70603-1
SPLITTER UID=SP3
FEED S70603-1
PRODUCT S70607,S70603-2
END

MEASUREMENT Z-TESTS USED IN THIS CALCULATION CYCLE

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PROBLEM AMMONIA CALCULATION SIMSCI STAFF
RESULTS MAY 94

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MEASUREMENT DATE:

*** CONVERGENCE NOT ATTAINED ***

NUMBER OF ITERATIONS = 10
MEASURED VARIABLES = 79 (74 NON-REDUNDANT)
UNMEASURED VARIABLES = 348 (322 UNOBSERVABLE)
FIXED VARIABLES = 48 (4 FIXED BY USER)
NUMBER OF EQUATIONS = 261
DEGREE OF REDUNDANCY = 2
NUMBER OF ACTIVE BOUNDS = 5

GLOBAL TEST (.950 CONFIDENCE LEVEL)

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TAU = .2277E+08 CRITICAL VALUE = 14.10

*** DID NOT PASS THE GLOBAL TEST ***

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STREAM REPORT

MEASUREMENT DATE:

STRM ID

-----		STANDARD	MEASURED	CALC	RE-	
VBL,STAT	UNIT	DEVIATION	Z-STAT	VALUE	MARK	

PURGE						
RATE,U	G-MOL/SEC			60.000		
TEMP,U	C			34.88		
PRES,F	BAR(GA)			17.900		
X1,	U MOL FRACTN				UO	
X2,	U MOL FRACTN				UO	
X3,	U MOL FRACTN				UO	
X4,	U MOL FRACTN				UO	
X5,	U MOL FRACTN				UO	
X6,	U MOL FRACTN				UO	
X7,	U MOL FRACTN				UO	
X8,	U MOL FRACTN				UO	
X9,	U MOL FRACTN				UO	
X10,	U MOL FRACTN				UO	
X11,	U MOL FRACTN				UO	
X12,	U MOL FRACTN				UO	
S70201						
RATE,M	G-MOL/SEC	FS201	134.829	.00	4494.294 4494.293	
TEMP,M	K	TS201	.56		290.32 290.32	NR
X1,	M MOL FRACTN	N2S2201	.001226		.024514 .024514	NR
X2,	M MOL FRACTN	MES201	.020109		.779889 .779889	NR
X3,	M MOL FRACTN	ETS201	.005010		.100459 .100459	NR
X4,	M MOL FRACTN	PRS70201	.002782		.055646 .055646	NR
X5,	M MOL FRACTN	IBUS201	.000656		.013127 .013127	NR
X6,	M MOL FRACTN	NBUS201	.000600		.011996 .011996	NR
X7,	M MOL FRACTN	IPENS201	.000185		.003697 .003697	NR
X8,	M MOL FRACTN	NPENS201	.000119		.002386 .002386	NR
X9,	M MOL FRACTN	HEXS201	.000100		.001706 .001706	NR
X10,	M MOL FRACTN	HEPS201	.000100		.000900 .000900	NR
X11,	M MOL FRACTN	CARS201	.000284		.005681 .005681	NR
X12,	U MOL FRACTN				.000000	
S70201-1						
RATE,U	G-MOL/SEC				4494.293	
TEMP,U	C					UO
PRES,M	BAR(GA)	PS201-1	.014		43.400 43.400	NR
X1,	U MOL FRACTN				.024514	
X2,	U MOL FRACTN				.779889	
X3,	U MOL FRACTN				.100459	
X4,	U MOL FRACTN				.055646	
X5,	U MOL FRACTN				.013127	
X6,	U MOL FRACTN				.011996	

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STREAM REPORT (CONT)

STRM ID	VBL,STAT	UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	CALC VALUE	RE-MARK
			X4,				UO
			X5,				UO
			X6,				UO
			X7,				UO
			X8,				UO
			X9,				UO
			X10,				UO
			X11,				UO
			X12,				UO
S70302							
			RATE,U G-MOL/SEC				UO
			TEMP,U K			271.47	
			PRES,U BAR(GA)				UO
			X1,				UO
			X2,				UO
			X3,				UO
			X4,				UO
			X5,				UO
			X6,				UO
			X7,				UO
			X8,				UO
			X9,				UO
			X10,				UO
			X11,				UO
			X12,				UO
S70303-1							
			RATE,U G-MOL/SEC				UO
			TEMP,U C				UO
			PRES,F BAR(GA)			37.800	
			X1,				UO
			X2,				UO
			X3,				UO
			X4,				UO
			X5,				UO
			X6,				UO
			X7,				UO
			X8,				UO
			X9,				UO
			X10,				UO
			X11,				UO
			X12,				UO

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STREAM REPORT (CONT)

STRM ID	VBL,STAT	UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT VALUE	CALC VALUE	RE- MARK
S70303							
	RATE,U	G-MOL/SEC			UO		
	TEMP,M	K	TS303	.56	233.90	233.90	NR
	PRES,U	BAR(GA)					UO
	X1, U	MOL FRACTN					UO
	X2, U	MOL FRACTN					UO
	X3, U	MOL FRACTN					UO
	X4, U	MOL FRACTN					UO
	X5, U	MOL FRACTN					UO
	X6, U	MOL FRACTN					UO
	X7, U	MOL FRACTN					UO
	X8, U	MOL FRACTN					UO
	X9, U	MOL FRACTN					UO
	X10, U	MOL FRACTN					UO
	X11, U	MOL FRACTN					UO
	X12, U	MOL FRACTN					UO
S70304							
	RATE,U	G-MOL/SEC					UO
	TEMP,U	K				233.90	
	PRES,U	BAR(GA)					UO
	X1, U	MOL FRACTN					UO
	X2, U	MOL FRACTN					UO
	X3, U	MOL FRACTN					UO
	X4, U	MOL FRACTN					UO
	X5, U	MOL FRACTN					UO
	X6, U	MOL FRACTN					UO
	X7, U	MOL FRACTN					UO
	X8, U	MOL FRACTN					UO
	X9, U	MOL FRACTN					UO
	X10, U	MOL FRACTN					UO
	X11, U	MOL FRACTN					UO
	X12, U	MOL FRACTN					UO
S70305							
	RATE,U	G-MOL/SEC					UO
	TEMP,M	K	TS305	.56	205.55	205.55	NR
	X1, U	MOL FRACTN					UO
	X2, U	MOL FRACTN					UO
	X3, U	MOL FRACTN					UO
	X4, U	MOL FRACTN					UO
	X5, U	MOL FRACTN					UO
	X6, U	MOL FRACTN					UO
	X7, U	MOL FRACTN					UO

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PROBLEM AMMONIA OUTPUT SIMSCI STAFF
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STREAM REPORT (CONT)

STRM ID		STANDARD	MEASURED	CALC	RE-	
-----	VBL,STAT UNIT TAGNAME	DEVIATION	Z-STAT	VALUE	VALUE	MARK
-----	-----	-----	-----	-----	-----	-----
	X2, U MOL FRACTN					UO
	X3, U MOL FRACTN					UO
	X4, U MOL FRACTN					UO
	X5, U MOL FRACTN					UO
	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO
	X10, U MOL FRACTN					UO
	X11, U MOL FRACTN					UO
	X12, U MOL FRACTN					UO
S70314						
	RATE,M G-MOL/SEC FS314	15.210		507.000	507.000	NR
	TEMP,M K TS314-1	.56		226.06	226.06	NR
	X1, U MOL FRACTN					UO
	X2, U MOL FRACTN					UO
	X3, U MOL FRACTN					UO
	X4, U MOL FRACTN					UO
	X5, U MOL FRACTN					UO
	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO
	X10, U MOL FRACTN					UO
	X11, U MOL FRACTN					UO
	X12, U MOL FRACTN					UO
S70315						
	RATE,U G-MOL/SEC			507.000		
	TEMP,M K TS315	.56		233.52	233.52	NR
	PRES,F BAR(GA)			15.400		
	X1, U MOL FRACTN					UO
	X2, U MOL FRACTN					UO
	X3, U MOL FRACTN					UO
	X4, U MOL FRACTN					UO
	X5, U MOL FRACTN					UO
	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO
	X10, U MOL FRACTN					UO
	X11, U MOL FRACTN					UO
	X12, U MOL FRACTN					UO

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STREAM REPORT (CONT)

STRM ID -----	VBL,STAT UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	CALC VALUE	RE- MARK
S70316						
	RATE,U G-MOL/SEC					UO
	TEMP,M K	TS316-1	.56		261.14 261.14	NR
	X1, U MOL FRACTN					UO
	X2, U MOL FRACTN					UO
	X3, U MOL FRACTN					UO
	X4, U MOL FRACTN					UO
	X5, U MOL FRACTN					UO
	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO
	X10, U MOL FRACTN					UO
	X11, U MOL FRACTN					UO
	X12, U MOL FRACTN					UO
S70317						
	RATE,U G-MOL/SEC					UO
	TEMP,U K					UO
	PRES,F BAR(GA)				15.400	
	X1, U MOL FRACTN					UO
	X2, U MOL FRACTN					UO
	X3, U MOL FRACTN					UO
	X4, U MOL FRACTN					UO
	X5, U MOL FRACTN					UO
	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO
	X10, U MOL FRACTN					UO
	X11, U MOL FRACTN					UO
	X12, U MOL FRACTN					UO
S70318						
	RATE,M G-MOL/SEC	FS318-1	24.000		800.000 800.000	NR
	TEMP,M K	TS318-1	.56		273.73 273.73	NR
	X1, U MOL FRACTN					UO
	X2, U MOL FRACTN					UO
	X3, U MOL FRACTN					UO
	X4, U MOL FRACTN					UO
	X5, U MOL FRACTN					UO
	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO

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STREAM REPORT (CONT)

STRM ID -----	VBL,STAT UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	CALC VALUE	RE- MARK

	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO
	X10, U MOL FRACTN					UO
	X11, U MOL FRACTN					UO
	X12, U MOL FRACTN					UO
S70323-1	RATE,U G-MOL/SEC					UO
	TEMP,U C					UO
	PRES,F BAR(GA)				30.100	
	X1, U MOL FRACTN					UO
	X2, U MOL FRACTN					UO
	X3, U MOL FRACTN					UO
	X4, U MOL FRACTN					UO
	X5, U MOL FRACTN					UO
	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO
	X10, U MOL FRACTN					UO
	X11, U MOL FRACTN					UO
	X12, U MOL FRACTN					UO
S70323	RATE,U G-MOL/SEC				783.155	
	TEMP,M K TS323		.56	278.95	278.95	NR
	PRES,F BAR(GA)				30.100	
	X1, U MOL FRACTN					UO
	X2, U MOL FRACTN					UO
	X3, U MOL FRACTN					UO
	X4, U MOL FRACTN					UO
	X5, U MOL FRACTN					UO
	X6, U MOL FRACTN					UO
	X7, U MOL FRACTN					UO
	X8, U MOL FRACTN					UO
	X9, U MOL FRACTN					UO
	X10, U MOL FRACTN					UO
	X11, U MOL FRACTN					UO
	X12, U MOL FRACTN					UO
S70328	RATE,U G-MOL/SEC					UO
	TEMP,M K TS328		.56	286.45	286.45	NR

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STREAM REPORT (CONT)

STRM ID	VBL,STAT	UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	VALUE	CALC VALUE	RE-MARK
	X2,	U	MOL FRACTN				.031800	
	X3,	U	MOL FRACTN				.954200	
	X4,	U	MOL FRACTN				.014000	
	X5,	U	MOL FRACTN					UO
	X6,	U	MOL FRACTN					UO
	X7,	U	MOL FRACTN					UO
	X8,	U	MOL FRACTN					UO
	X9,	U	MOL FRACTN					UO
	X10,	U	MOL FRACTN					UO
	X11,	U	MOL FRACTN				.000000	
	X12,	U	MOL FRACTN					UO
S70401	RATE,U	G-MOL/SEC					783.155	
	TEMP,M	K	TS401	.56		317.35	317.35	NR
	PRES,F	BAR(GA)					29.900	
	X1,	U	MOL FRACTN					UO
	X2,	U	MOL FRACTN					UO
	X3,	U	MOL FRACTN					UO
	X4,	U	MOL FRACTN					UO
	X5,	U	MOL FRACTN					UO
	X6,	U	MOL FRACTN					UO
	X7,	U	MOL FRACTN					UO
	X8,	U	MOL FRACTN					UO
	X9,	U	MOL FRACTN					UO
	X10,	U	MOL FRACTN					UO
	X11,	U	MOL FRACTN					UO
	X12,	U	MOL FRACTN					UO
S70404	RATE,U	G-MOL/SEC						UO
	TEMP,M	K	TS404	.56		276.55	276.55	NR
	PRES,M	BAR(GA)	PS405	.014	>999	26.990	-1.003	E&NR
	X1,	M	MOL FRACTN	NIS404	.000100	.000000	.000000	NR
	X2,	M	MOL FRACTN	MES404	.001590	.031800	.031800	NR
	X3,	M	MOL FRACTN	ETS404	023982	.954200	.954200	NR
	X4,	M	MOL FRACTN	PRS404	.000700	.014000	.014000	NR
	X5,	U	MOL FRACTN					UO
	X6,	U	MOL FRACTN					UO
	X7,	U	MOL FRACTN					UO
	X8,	U	MOL FRACTN					UO
	X9,	U	MOL FRACTN					UO
	X10,	U	MOL FRACTN					UO
	X11,	M	MOL FRACTN	CARS404	.000100	.000000	.000000	NR
	X12,	U	MOL FRACTN					UO


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STREAM REPORT (CONT)

STRM ID	VBL,STAT	UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	VALUE	CALC VALUE	RE-MARK
			X10, U MOL FRACTN					UO
			X11, U MOL FRACTN					UO
			X12, U MOL FRACTN					UO
S70409-1								
			RATE,U G-MOL/SEC					UO
			TEMP,U C					UO
			PRES,F BAR(GA)			15.062		
			X1, U MOL FRACTN					UO
			X2, U MOL FRACTN					UO
			X3, U MOL FRACTN					UO
			X4, U MOL FRACTN					UO
			X5, U MOL FRACTN					UO
			X6, U MOL FRACTN					UO
			X7, U MOL FRACTN					UO
			X8, U MOL FRACTN					UO
			X9, U MOL FRACTN					UO
			X10, U MOL FRACTN					UO
			X11, U MOL FRACTN					UO
			X12, U MOL FRACTN					UO
S70410								
			RATE,U G-MOL/SEC					UO
			TEMP,U K					UO
			PRES,U BAR(GA)					UO
			X1, U MOL FRACTN					UO
			X2, U MOL FRACTN					UO
			X3, U MOL FRACTN					UO
			X4, U MOL FRACTN					UO
			X5, U MOL FRACTN					UO
			X6, U MOL FRACTN					UO
			X7, U MOL FRACTN					UO
			X8, U MOL FRACTN					UO
			X9, U MOL FRACTN					UO
			X10, U MOL FRACTN					UO
			X11, U MOL FRACTN					UO
			X12, U MOL FRACTN					UO
S70411-1								
			RATE,U G-MOL/SEC				753.106	
			TEMP,U K					UO
			PRES,U BAR(GA)					UO
			X1, U MOL FRACTN					UO
			X2, U MOL FRACTN			.000700		
			X3, U MOL FRACTN			.002200		

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STREAM REPORT (CONT)

STRM ID		STANDARD	MEASURED	CALC	RE-
-----		DEVIATION	Z-STAT	VALUE	MARK
VBL,STAT	UNIT TAGNAME			VALUE	
	X6, U MOL FRACTN				UO
	X7, U MOL FRACTN				UO
	X8, U MOL FRACTN				UO
	X9, U MOL FRACTN				UO
	X10, U MOL FRACTN				UO
	X11, U MOL FRACTN				UO
	X12, U MOL FRACTN				UO
S70412					
	RATE,U G-MOL/SEC			753.106	
	TEMP,M K TS412	.56	295.31	295.31	NR
	PRES,F BAR(GA)			16.500	
	X1, U MOL FRACTN				UO
	X2, U MOL FRACTN			.000700	
	X3, U MOL FRACTN			.002200	
	X4, U MOL FRACTN			.997100	
	X5, U MOL FRACTN				UO
	X6, U MOL FRACTN				UO
	X7, U MOL FRACTN				UO
	X8, U MOL FRACTN				UO
	X9, U MOL FRACTN				UO
	X10, U MOL FRACTN				UO
	X11, U MOL FRACTN				UO
	X12, U MOL FRACTN				UO
S70413P					
	RATE,M G-MOL/SEC FS413	4.564	152.146	152.146	NR
	TEMP,M K TS413	.56	4.90	294.96	296.88
	X1, U MOL FRACTN				UO
	X2, M MOL FRACTN MES413	.000100	.000700	.000700	NR
	X3, M MOL FRACTN ETS413	.000110	.002200	.002200	NR
	X4, M MOL FRACTN PRS413	.024936	.997100	.997100	NR
	X5, U MOL FRACTN				UO
	X6, U MOL FRACTN				UO
	X7, U MOL FRACTN				UO
	X8, U MOL FRACTN				UO
	X9, U MOL FRACTN				UO
	X10, U MOL FRACTN				UO
	X11, U MOL FRACTN				UO
	X12, U MOL FRACTN				UO
S70414					
	RATE,M G-MOL/SEC FS415	7.627	254.236	254.236	NR
	TEMP,M K TS414	.56	338.12	338.12	NR
	X1, U MOL FRACTN				UO

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STREAM REPORT (CONT)

STRM ID	VBL,STAT UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	CALC VALUE	RE-MARK
X2,	U	MOL FRACTN				UO
X3,	M	MOL FRACTN ETS415	.000100	.000500	.000500	NR
X4,	M	MOL FRACTN PRS415	.016749	.628700	.628700	NR
X5,	M	MOL FRACTN ISBS415	.007002	.190100	.190100	NR
X6,	M	MOL FRACTN NBS415	.006584	.171300	.171300	NR
X7,	M	MOL FRACTN IPENS415	.000420	.008400	.008400	NR
X8,	M	MOL FRACTN NPENS415	.000100	.001000	.001000	NR
X9,	U	MOL FRACTN				UO
X10,	U	MOL FRACTN				UO
X11,	U	MOL FRACTN				UO
X12,	U	MOL FRACTN				UO
S70416						
RATE,M	G-MOL/SEC	FS418	1.080	35.997	35.997	NR
TEMP,M	K	TS416	.56	437.74	437.74	NR
X1,	U	MOL FRACTN				UO
X2,	U	MOL FRACTN				UO
X3,	U	MOL FRACTN				UO
X4,	U	MOL FRACTN				UO
X5,	U	MOL FRACTN				UO
X6,	M	MOL FRACTN NBUS418	.001031	.020611	.020611	NR
X7,	M	MOL FRACTN IPENS418	.011044	.372000	.372000	NR
X8,	M	MOL FRACTN NPENS418	.009073	.283300	.283300	NR
X9,	M	MOL FRACTN HEXS318	.006921	.186460	.186460	NR
X10,	M	MOL FRACTN HEPS418	.005837	.137650	.137650	NR
X11,	U	MOL FRACTN				UO
X12,	U	MOL FRACTN				UO
S70419						
RATE,U	G-MOL/SEC					UO
TEMP,U	C					UO
PRES,F	BAR(GA)			30.009		
X1,	U	MOL FRACTN				UO
X2,	U	MOL FRACTN				UO
X3,	U	MOL FRACTN				UO
X4,	U	MOL FRACTN				UO
X5,	U	MOL FRACTN				UO
X6,	U	MOL FRACTN				UO
X7,	U	MOL FRACTN				UO
X8,	U	MOL FRACTN				UO
X9,	U	MOL FRACTN				UO
X10,	U	MOL FRACTN				UO
X11,	U	MOL FRACTN				UO
X12,	U	MOL FRACTN				UO

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STREAM REPORT (CONT)

STRM ID	UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT VALUE	CALC VALUE	RE- MARK

X10, U MOL FRACTN						UO
X11, U MOL FRACTN						UO
X12, U MOL FRACTN						UO
S70423						
RATE, U G-MOL/SEC					783.155	
TEMP, U C						UO
X1, U MOL FRACTN						UO
X2, U MOL FRACTN						UO
X3, U MOL FRACTN						UO
X4, U MOL FRACTN						UO
X5, U MOL FRACTN						UO
X6, U MOL FRACTN						UO
X7, U MOL FRACTN						UO
X8, U MOL FRACTN						UO
X9, U MOL FRACTN						UO
X10, U MOL FRACTN						UO
X11, U MOL FRACTN						UO
X12, U MOL FRACTN						UO
S70601						
RATE, U G-MOL/SEC					3651.138	
TEMP, M K		TS601	.56	308.03	308.03	NR
PRES, M BAR(GA)		PS601	.014	15.006	15.006	NR
X1, U MOL FRACTN						UO
X2, U MOL FRACTN						UO
X3, U MOL FRACTN						UO
X4, U MOL FRACTN						UO
X5, U MOL FRACTN						UO
X6, U MOL FRACTN						UO
X7, U MOL FRACTN						UO
X8, U MOL FRACTN						UO
X9, U MOL FRACTN						UO
X10, U MOL FRACTN						UO
X11, U MOL FRACTN						UO
X12, U MOL FRACTN						UO
S70602-1						
RATE, U G-MOL/SEC						UO
TEMP, U C					112.43	
PRES, F BAR(GA)					45.000	
X1, U MOL FRACTN						UO
X2, U MOL FRACTN						UO
X3, U MOL FRACTN						UO
X4, U MOL FRACTN						UO
X5, U MOL FRACTN						UO

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STREAM REPORT (CONT)

STRM ID

VBL,STAT	UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	CALC VALUE	RE- MARK

X6,	U MOL FRACTN					UO
X7,	U MOL FRACTN					UO
X8,	U MOL FRACTN					UO
X9,	U MOL FRACTN					UO
X10,	U MOL FRACTN					UO
X11,	U MOL FRACTN					UO
X12,	U MOL FRACTN					UO
S70602-2						
RATE,U	G-MOL/SEC					UO
TEMP,M	K	TS602	.56	35.78	399.64 385.58	E&NR
PRES,M	BAR(GA)	PS602	.014		45.000 45.000	NR
X1,	U MOL FRACTN					UO
X2,	U MOL FRACTN					UO
X3,	U MOL FRACTN					UO
X4,	U MOL FRACTN					UO
X5,	U MOL FRACTN					UO
X6,	U MOL FRACTN					UO
X7,	U MOL FRACTN					UO
X8,	U MOL FRACTN					UO
X9,	U MOL FRACTN					UO
X10,	U MOL FRACTN					UO
X11,	U MOL FRACTN					UO
X12,	U MOL FRACTN					UO
S70603M						
RATE,U	G-MOL/SEC				3651.138	
TEMP,U	C					UO
X1,	U MOL FRACTN					UO
X2,	U MOL FRACTN					UO
X3,	U MOL FRACTN					UO
X4,	U MOL FRACTN					UO
X5,	U MOL FRACTN					UO
X6,	U MOL FRACTN					UO
X7,	U MOL FRACTN					UO
X8,	U MOL FRACTN					UO
X9,	U MOL FRACTN					UO
X10,	U MOL FRACTN					UO
X11,	U MOL FRACTN					UO
X12,	U MOL FRACTN					UO
S70603-1						
RATE,U	G-MOL/SEC					UO
TEMP,U	C					UO
PRES,F	BAR(GA)				43.200	
X1,	U MOL FRACTN					UO

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STREAM REPORT (CONT)

Table with columns: STRM ID, VBL, STAT, UNIT, TAGNAME, STANDARD DEVIATION, MEASURED Z-STAT, CALC VALUE, RE-MARK. Rows include stream data for X2-X12, S70603, and S70603-2.

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STREAM REPORT (CONT)

STRM ID

-----	STANDARD	MEASURED	CALC	RE-
VBL,STAT UNIT TAGNAME	DEVIATION	Z-STAT	VALUE	MARK
-----	-----	-----	-----	-----
X6, U MOL FRACTN				UO
X7, U MOL FRACTN				UO
X8, U MOL FRACTN				UO
X9, U MOL FRACTN				UO
X10, U MOL FRACTN				UO
X11, U MOL FRACTN				UO
X12, U MOL FRACTN				UO
S70608-1				
RATE,U G-MOL/SEC				UO
TEMP,U K				UO
X1, U MOL FRACTN				UO
X2, U MOL FRACTN				UO
X3, U MOL FRACTN				UO
X4, U MOL FRACTN				UO
X5, U MOL FRACTN				UO
X6, U MOL FRACTN				UO
X7, U MOL FRACTN				UO
X8, U MOL FRACTN				UO
X9, U MOL FRACTN				UO
X10, U MOL FRACTN				UO
X11, U MOL FRACTN				UO
X12, U MOL FRACTN				UO

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PROBLEM AMMONIA OUTPUT SIMSCI STAFF
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HEAT EXCHANGER DUTY AND UA VALUES

MEASUREMENT DATE:

HEAT EXNGR	DUTY (M*WATT)	UA (KW/K)
E1	UNOBSERVABLE	UNOBSERVABLE
E70404	UNOBSERVABLE	UNOBSERVABLE
E70408	UNOBSERVABLE	UNOBSERVABLE

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 RESULTS MAY 94

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HEATER UNITS

MEASUREMENT DATE:

UNIT ID	VBL,STAT	UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	CALCULATE VALUE	RE-MARK
E70301-2			DUTY,U M*WATT				UO
E70301-3			DUTY,U M*WATT				UO
E70301-1			DUTY,U M*BTU/HR				UO
E70301-5			DUTY,U M*WATT				UO
E70301-6			DUTY,U M*WATT				UO
E70301-4			DUTY,U M*WATT				UO
E70301-7			DUTY,U M*WATT				UO
E70302-2			DUTY,U M*WATT				UO
E70302			DUTY,U M*WATT				UO
E70302-4			DUTY,U M*WATT				UO
E70302-3			DUTY,U M*WATT				UO
E70405			DUTY,U M*WATT				UO
E70406-1			DUTY,U M*WATT				UO
E70406-2			DUTY,U M*WATT				UO

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HEATER UNITS (CONT)

UNIT ID	VBL,STAT	UNIT	TAGNAME	STANDARD DEVIATION	MEASURED Z-STAT	CALCULATE VALUE	RE- MARK
E70407							
			DUTY,U			M*WATT	UO
H1							
			DUTY,U			M*WATT	UO
H2							
			DUTY,U			M*WATT	UO

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SPLITTER: SPLIT FRACTIONS

MEASUREMENT DATE:

UNIT ID			STANDARD	MEASURED	CALCULATE		RE-
STRM ID	ST	TAGNAME	DEVIATION Z-STAT	VALUE	VALUE		MARK

SP1							
S70420	U				.79798		
S70413P	U				.20202		
SP2							
PURGE	U				.01617		
S70601	U				.98383		
SP3							
S70607	U						UO
S70603-2	U						UO
SP4							
S70605	U						UO
S70603-1	U						UO
SP8							
S70422	U						UO
S70323-1	U						UO
SP9							
S70602-1	U						UO
S70602-2	U						UO

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FLASH UNITS

MEASUREMENT DATE:

UNIT ID	VBL, STAT	UNIT	TAGNAME	STANDARD DEVIATION	Z-STAT	MEASURED VALUE	CALCULATE VALUE	RE-MARK
D70301								
			TD70301	.56		271.47	271.47	NR
								UO
							.00000	
D70302								
							77.39	
								UO
							.00000	
D70303								
							76.85	
							.00000	
D70402								
								UO
								UO
							.00000	

*** NOTE ***

ERR?: CANDIDATE OF GROSS ERROR
 NR : NON-REDUNDANT
 UO : UNOBSERVABLE
 E&NR: ERROR AND NON-REDUNDANT

CURRICULUM VITAE

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