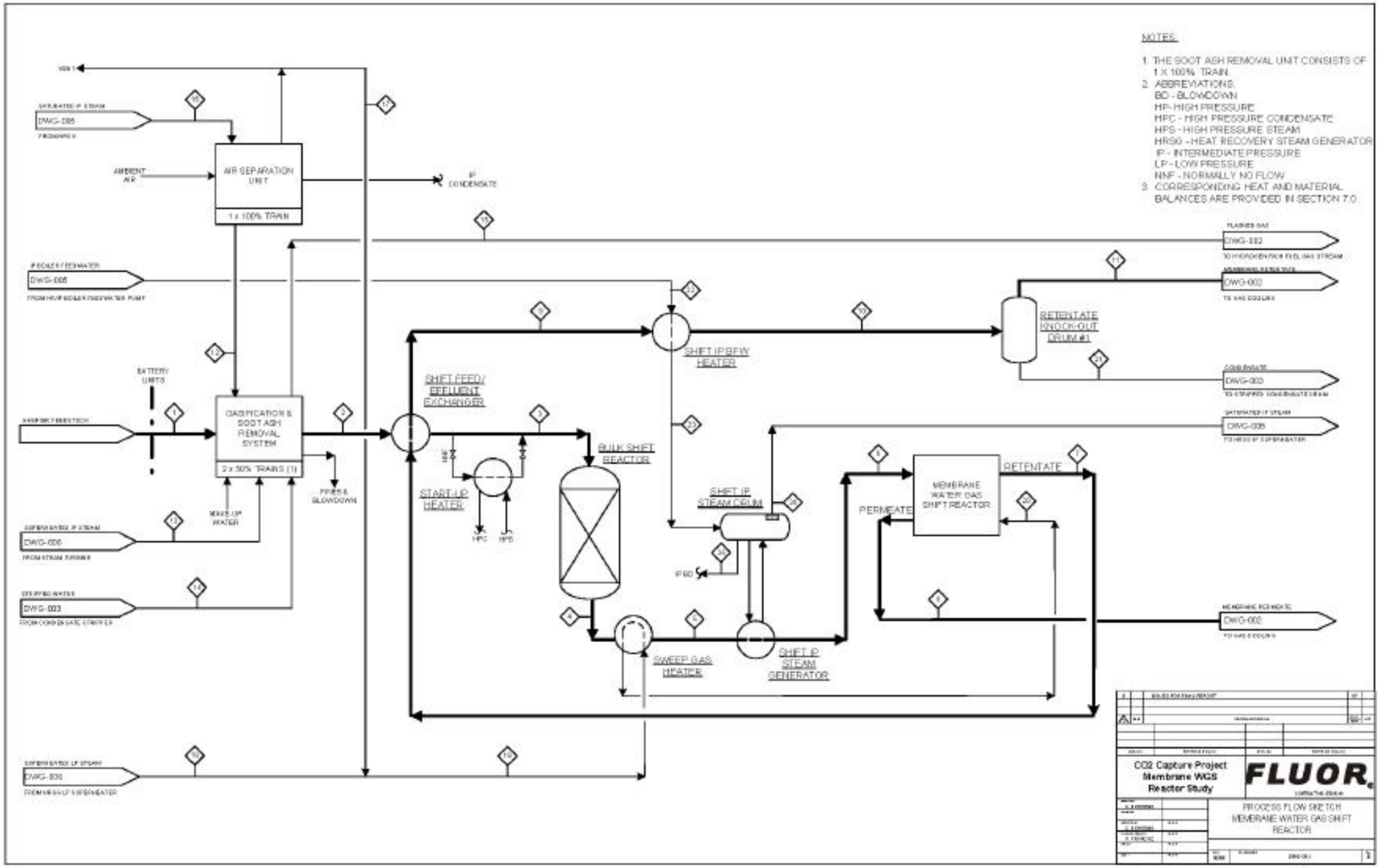
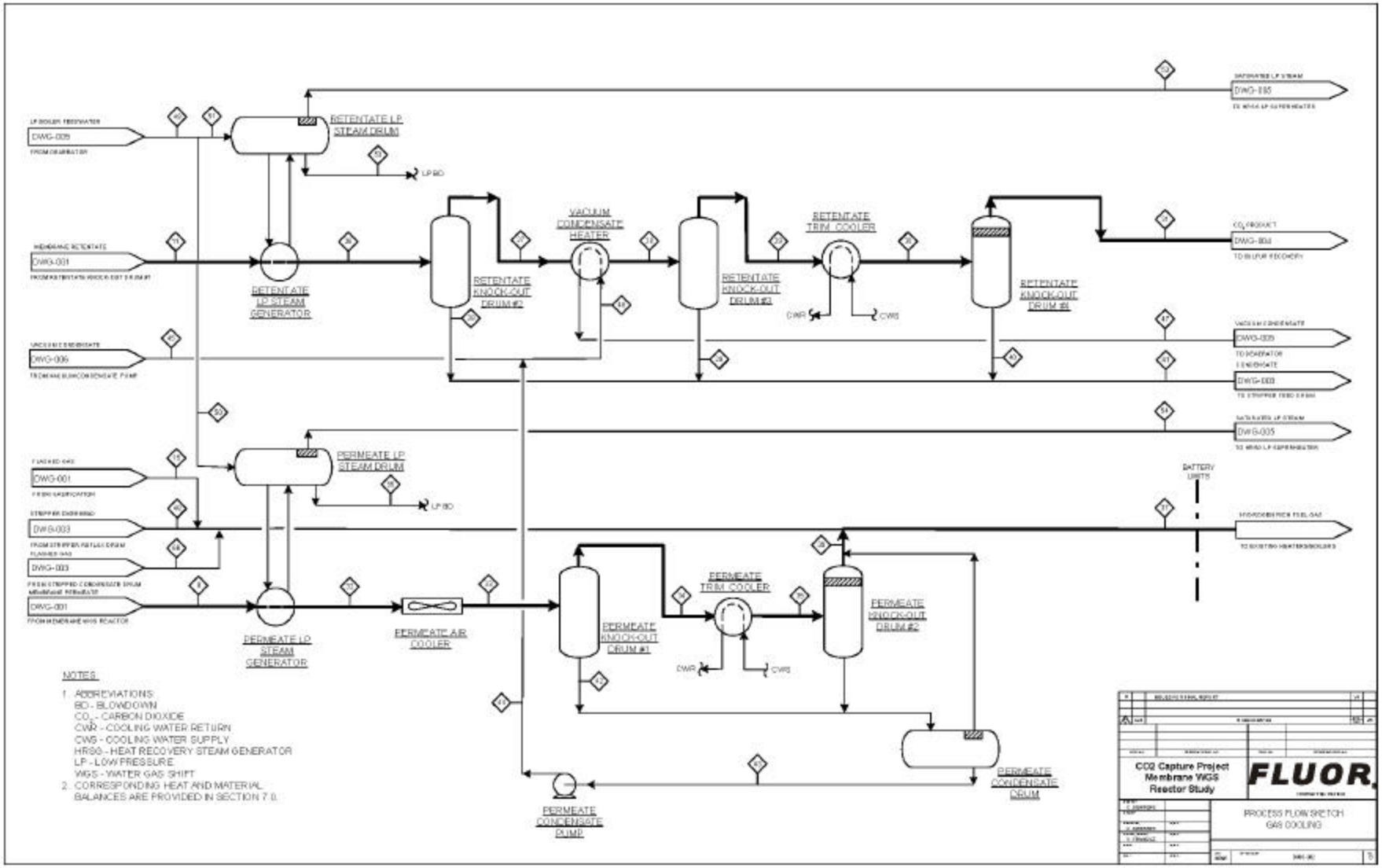
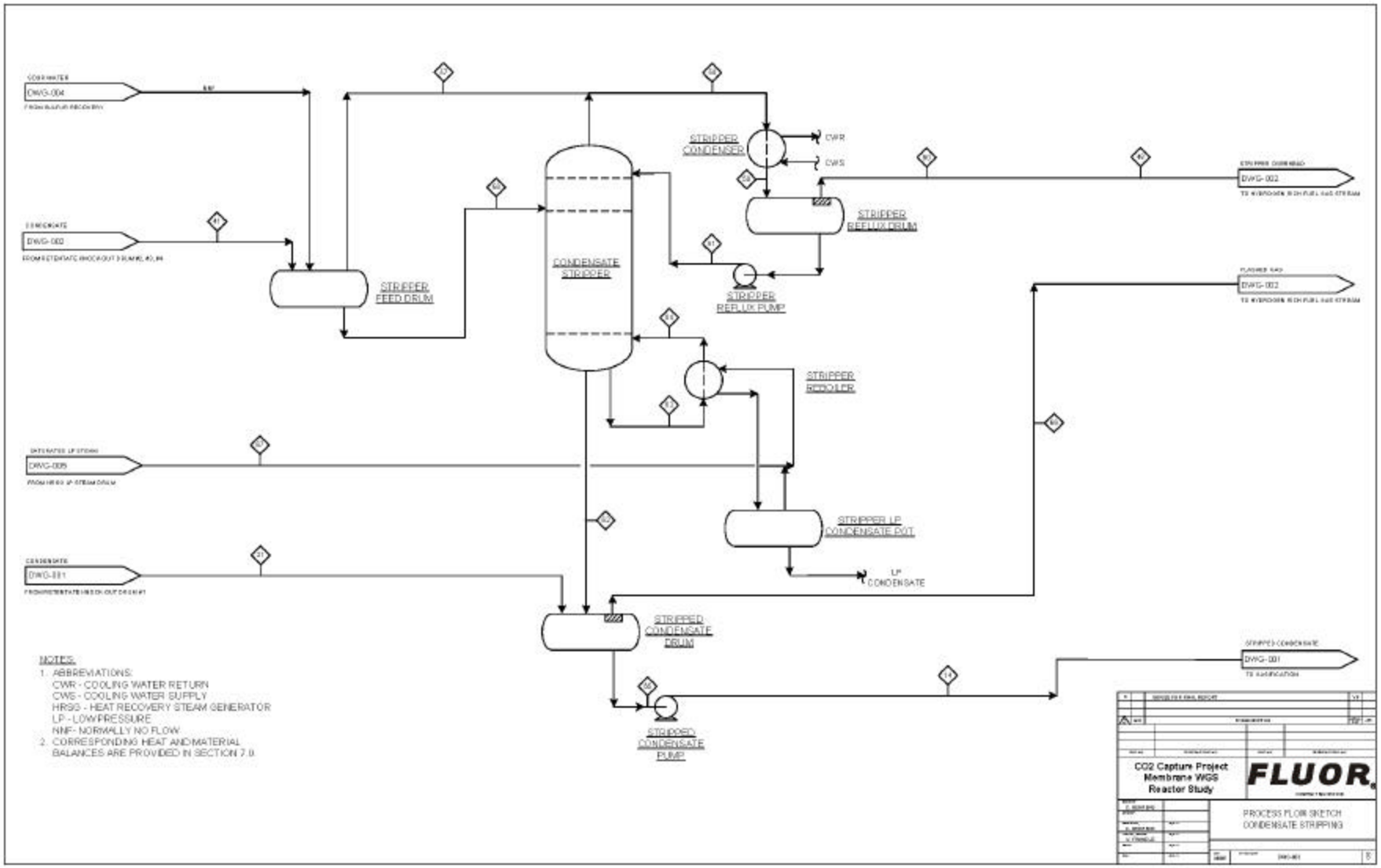
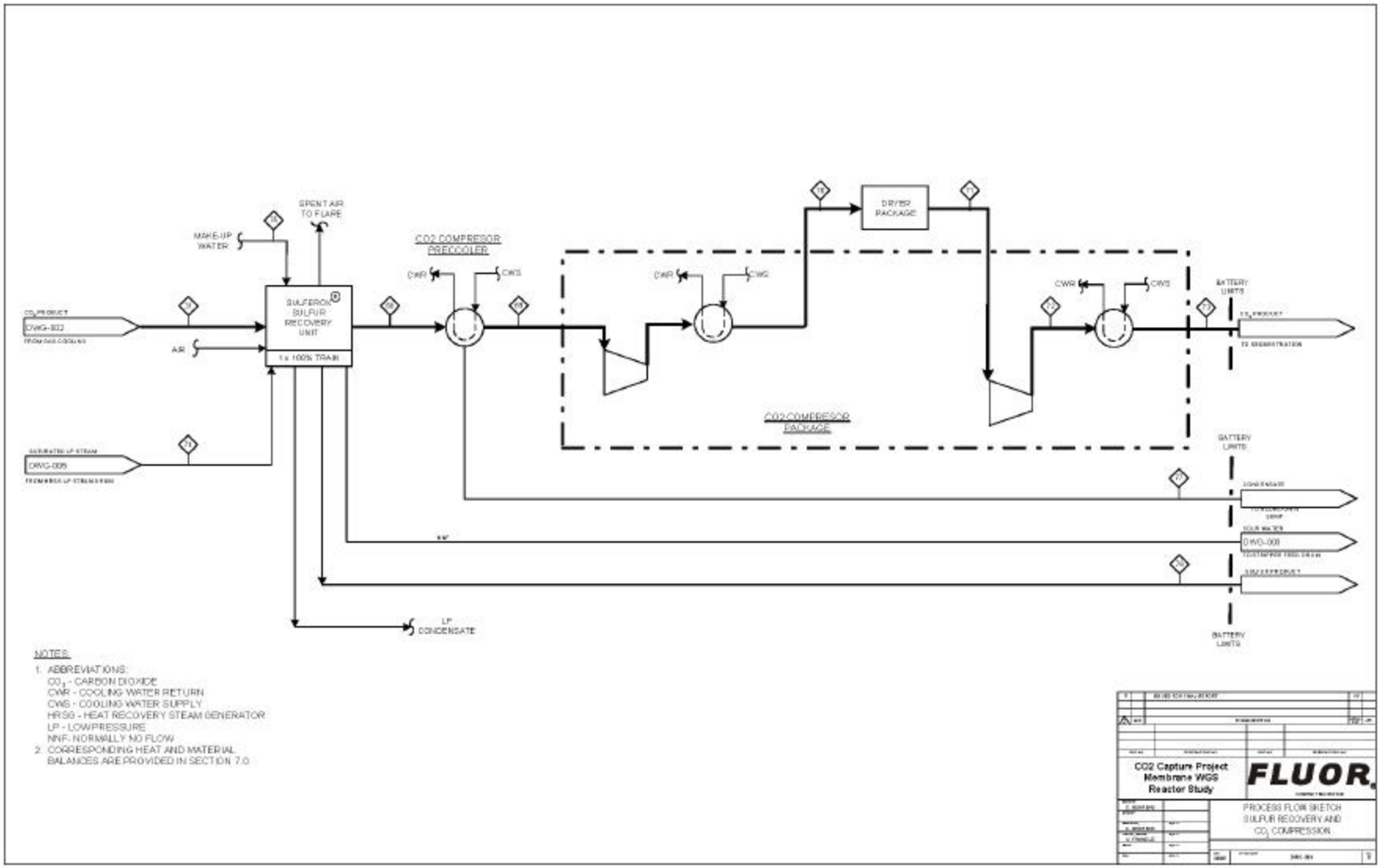
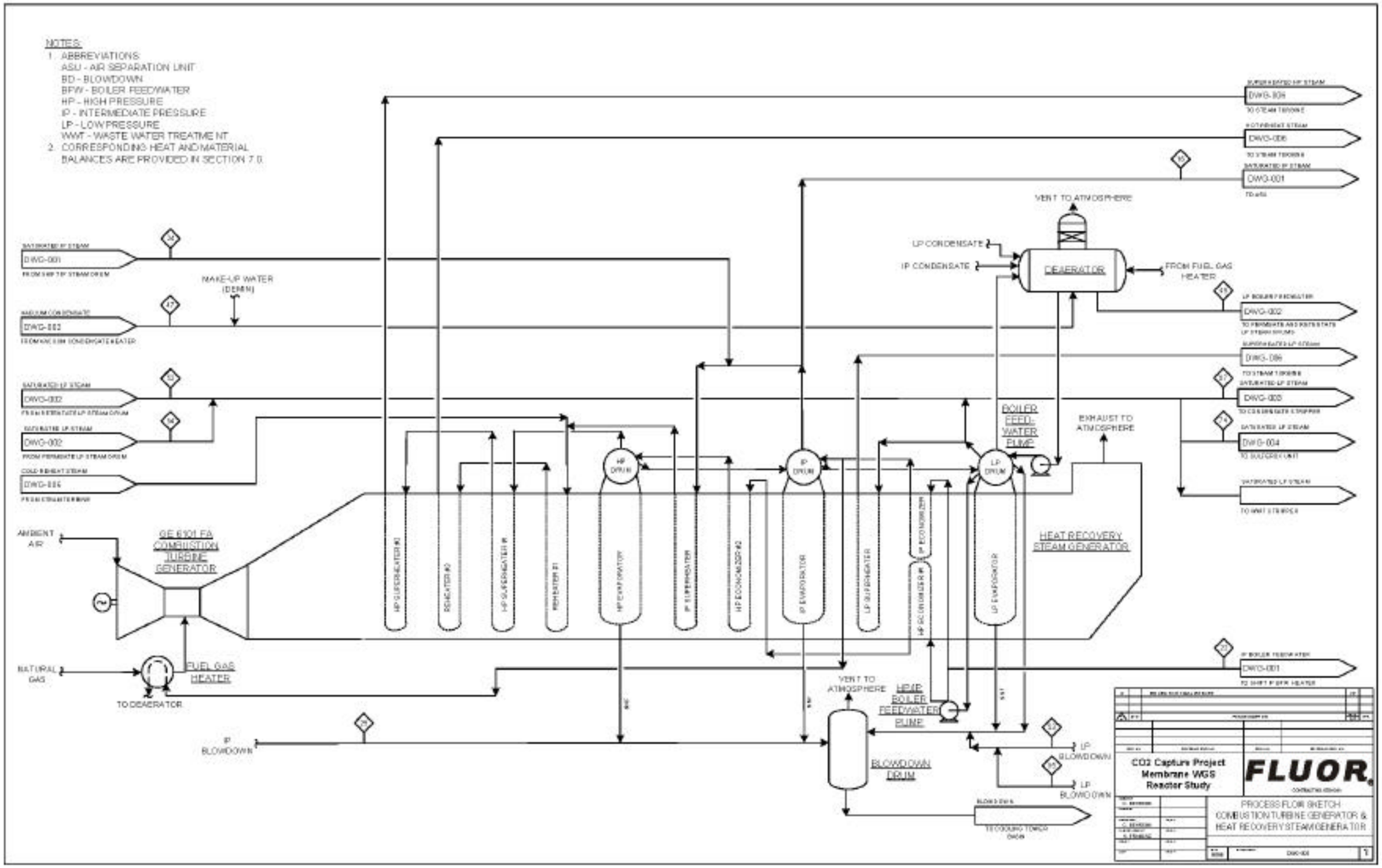
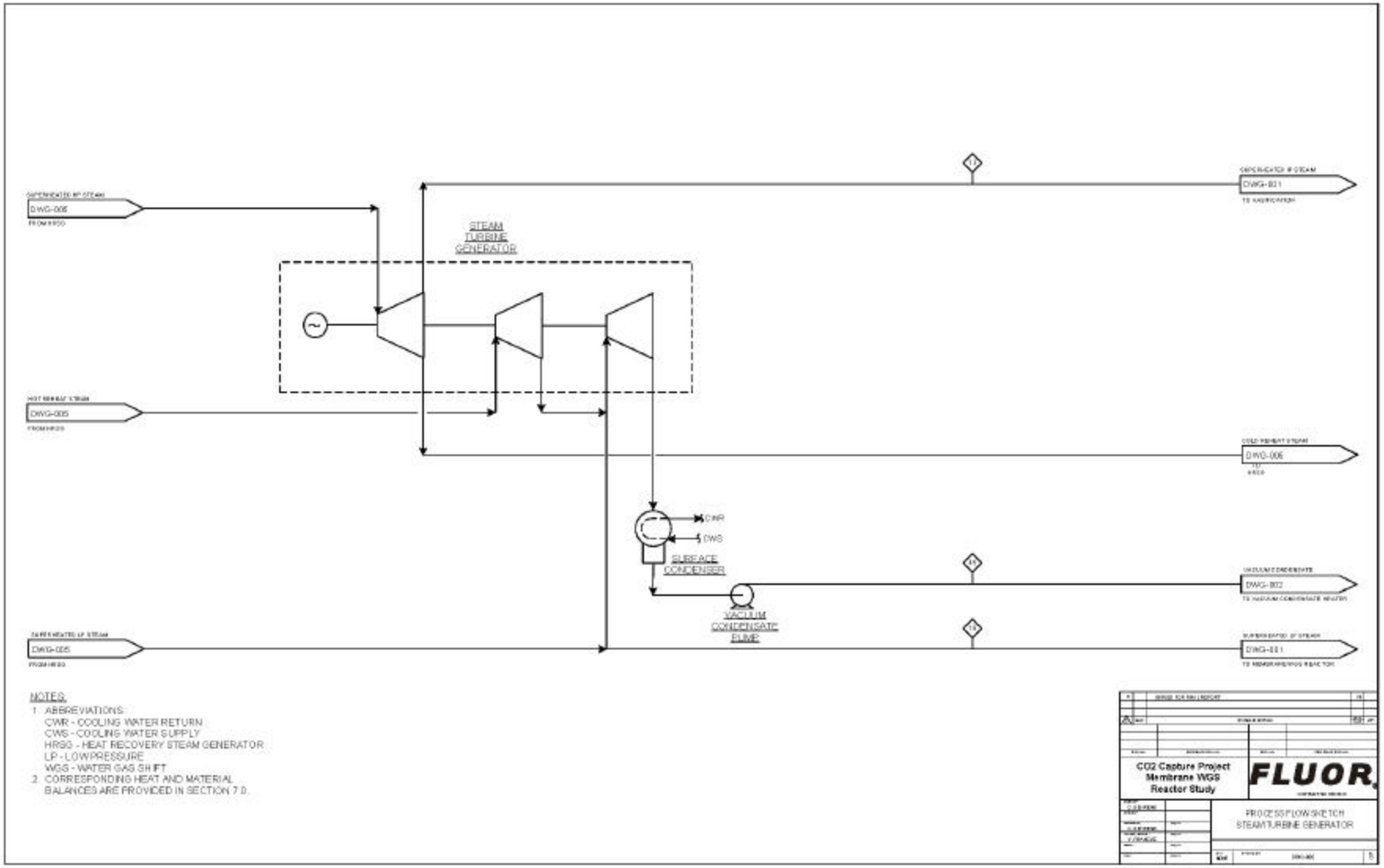

NOTES:
1. THE SOOT ASH REMOVAL UNIT CONSISTS OF 1 X 100% TRAIN.
2. ABBREVIATIONS.
BD - BLOWDOWN
HP- HIGH PRESSURE
HPC - HIGH PRESSURE CONDENSATE
HPS - HIGH PRESSURE STEAM
HRSG - HEAT RECOVERY STEAM GENERATOR
IP - INTERMEDIATE PRESSURE
LP - LOW PRESSURE
NNF - NORMALLY NO FLOW
3. CORRESPONDING HEAT AND MATERIAL BALANCES ARE PROVIDED IN SECTION 7.0.
AIR SEPARATION UNIT
1 x 100% TRAIN
AMBIENT AIR
IP CONDENSATE
DWG-005
BATTERY LIMITS
GASIFICATION & SOOT ASH REMOVAL SYSTEM
2 x 50% TRAINS (1)
MAKE-UP WATER
FINES & BLOWDOWN
DWG-006
DWG-003
DWG-004
SHIFT FEED/ EFFLUENT EXCHANGER
START-UP HEATER
HPC
HPS
BULK SHIFT REACTOR
SHIFT IP BFW HEATER
SHIFT IP STEAM DRUM
IP BD
SWEEP GAS HEATER
SHIFT IP STEAM GENERATOR
RETENTATE KNOCK-OUT DRUM #1
MEMBRANE WATER GAS SHIFT REACTOR
PERMEATE
RETENTATE
DWG-002
DWG-003
DWG-005
DWG-002
DWG-006
CO2 Capture Project
Membrane WGS
Reactor Study
FLUOR
PROCESS FLOW SKETCH
MEMBRANE WATER GAS SHIFT
REACTOR

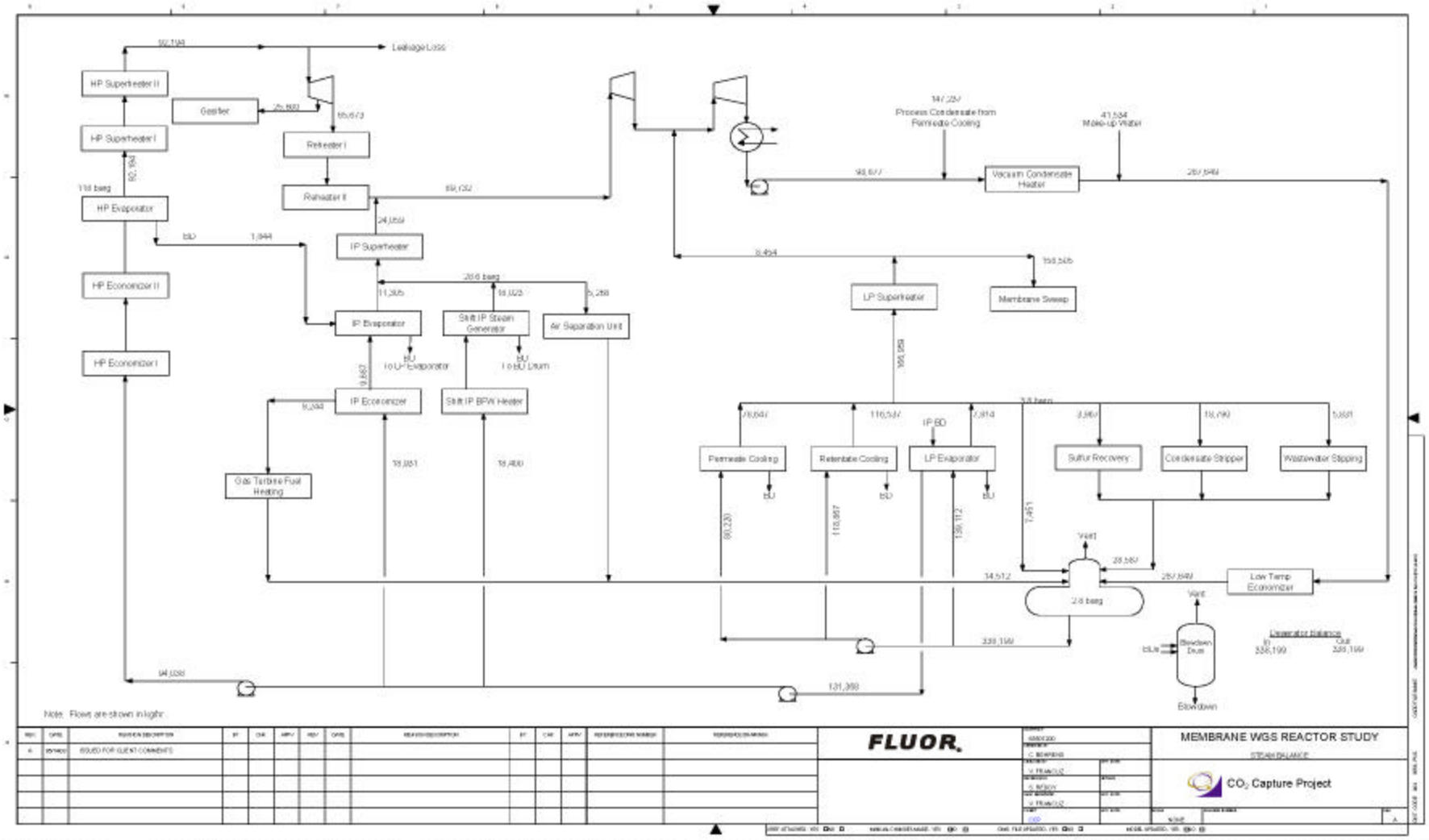

RETENTATE LP STEAM DRUM
LP BD
RETENTATE LP STEAM GENERATOR
RETENTATE KNOCK-OUT DRUM #2
VACUUM CONDENSATE HEATER
RETENTATE KNOCK-OUT DRUM #3
RETENTATE TRIM COOLER
CWR
CWS
RETENTATE KNOCK-OUT DRUM #4
PERMEATE LP STEAM DRUM
LP BD
PERMEATE LP STEAM GENERATOR
PERMEATE AIR COOLER
PERMEATE KNOCK-OUT DRUM #1
PERMEATE TRIM COOLER
CWR
CWS
PERMEATE KNOCK-OUT DRUM #2
PERMEATE CONDENSATE DRUM
PERMEATE CONDENSATE PUMP
BATTERY LIMITS
NOTES
1. ABBREVIATIONS
BD - BLOWDOWN
CO2 - CARBON DIOXIDE
CWR - COOLING WATER RETURN
CWS - COOLING WATER SUPPLY
HRSG - HEAT RECOVERY STEAM GENERATOR
LP - LOW PRESSURE
WGS - WATER GAS SHIFT
2. CORRESPONDING HEAT AND MATERIAL BALANCES ARE PROVIDED IN SECTION 7.0.
CO2 Capture Project
Membrane WGS
Reactor Study
FLUOR
PROCESS FLOW SKETCH
GAS COOLING


DWG-004
DWG-002
DWG-005
DWG-001
STRIPPER CONDENSER
CWR
CWS
STRIPPER REFLUX DRUM
STRIPPER REFLUX PUMP
CONDENSATE STRIPPER
STRIPPER FEED DRUM
STRIPPER REBOILER
STRIPPER LP CONDENSATE POT
LP CONDENSATE
STRIPPED CONDENSATE DRUM
STRIPPED CONDENSATE PUMP
DWG-002
DWG-002
DWG-001
NOTES:
1. ABBREVIATIONS:
CWR - COOLING WATER RETURN
CWS - COOLING WATER SUPPLY
HRSG - HEAT RECOVERY STEAM GENERATOR
LP - LOW PRESSURE
NNF - NORMALLY NO FLOW
2. CORRESPONDING HEAT AND MATERIAL BALANCES ARE PROVIDED IN SECTION 7.0
CO2 Capture Project
Membrane WGS
Reactor Study
FLUOR
PROCESS FLOW SKETCH
CONDENSATE STRIPPING


MAKE-UP WATER
SPENT AIR TO FLARE
CO2 COMPRESSOR PRECOOLER
CWR
CWS
DRYER PACKAGE
BATTERY LIMITS
AIR
SULFEROX SULFUR RECOVERY UNIT
1 x 100% TRAIN
CO2 COMPRESSOR PACKAGE
DWG-003
DWG-005
LP CONDENSATE
NOTES:
1. ABBREVIATIONS:
CO2 - CARBON DIOXIDE
CWR - COOLING WATER RETURN
CWS - COOLING WATER SUPPLY
HRSG - HEAT RECOVERY STEAM GENERATOR
LP - LOW PRESSURE
NNF- NORMALLY NO FLOW
2. CORRESPONDING HEAT AND MATERIAL BALANCES ARE PROVIDED IN SECTION 7.0
CO2 Capture Project
Membrane WGS
Reactor Study
FLUOR
PROCESS FLOW SKETCH
SULFUR RECOVERY AND
CO2 COMPRESSION


NOTES:
1. ABBREVIATIONS:
ASU - AIR SEPARATION UNIT
BD - BLOWDOWN
BFW - BOILER FEEDWATER
HP - HIGH PRESSURE
IP - INTERMEDIATE PRESSURE
LP - LOW PRESSURE
WWT - WASTE WATER TREATMENT
2. CORRESPONDING HEAT AND MATERIAL BALANCES ARE PROVIDED IN SECTION 7.0.
DWG-001
DWG-002
DWG-003
DWG-004
DWG-005
DWG-006
DWG-007
DWG-008
MAKE-UP WATER (DEMIN)
VENT TO ATMOSPHERE
LP CONDENSATE
IP CONDENSATE
DEAERATOR
FROM FUEL GAS HEATER
BOILER FEED WATER PUMP
EXHAUST TO ATMOSPHERE
HEAT RECOVERY STEAM GENERATOR
AMBIENT AIR
GE 6101 FA COMBUSTION TURBINE GENERATOR
NATURAL GAS
FUEL GAS HEATER
TO DEAERATOR
IP BLOWDOWN
VENT TO ATMOSPHERE
HEAT BOILER FEEDWATER PUMP
BLOWDOWN DRUM
LP BLOWDOWN
LP BLOWDOWN
TO COOLING TOWER
HP DRUM
IP DRUM
LP DRUM
CO2 Capture Project
Membrane WGS
Reactor Study
FLUOR
PROCESS FLOW SKETCH
COMBUSTION TURBINE GENERATOR &
HEAT RECOVERY STEAM GENERATOR


STEAM TURBINE GENERATOR
DWG-005
DWG-005
DWG-005
DWG-003
DWG-801
DWG-006
DWG-802
DWG-001
CWR
CWS
SURFACE CONDENSER
VACUUM CONDENSATE PUMP
NOTES:
1. ABBREVIATIONS:
CWR - COOLING WATER RETURN
CWS - COOLING WATER SUPPLY
HRSG - HEAT RECOVERY STEAM GENERATOR
LP - LOW PRESSURE
WGS - WATER GAS SHIFT
2. CORRESPONDING HEAT AND MATERIAL BALANCES ARE PROVIDED IN SECTION 7.0.
CO2 Capture Project
Membrane WGS
Reactor Study
FLUOR
PROCESS FLOW SHEET
STEAM TURBINE GENERATOR


Leakage Loss
HP Superheater II
HP Superheater I
HP Evaporator
HP Economizer II
HP Economizer I
Gasifier
Reheater I
Reheater II
IP Superheater
IP Evaporator
IP Economizer
Shift IP Steam Generator
Shift IP BFW Heater
Air Separation Unit
Gas Turbine Fuel Heating
LP Superheater
Membrane Sweep
Vacuum Condensate Heater
Process Condensate from Permeate Cooling
Make-up Water
Permeate Cooling
Retentate Cooling
LP Evaporator
Sulfur Recovery
Condensate Stripper
Wastewater Stripping
Vent
Low Temp Economizer
Blowdown Drum
Blowdown
Note: Flows are shown in lb/hr
FLUOR
MEMBRANE WGS REACTOR STUDY
STEAM BALANCE
CO2 Capture Project

7.0 HEAT AND MATERIAL BALANCE

The heat and material balances corresponding to the process schematics (in Section 6.0) are shown in Table 7-1.

Table 7-1 – Heat and Material Balance

Stream Description		Fuel Gas and Fuel Oil to Gasifier		Syngas from Gasification Island to Shift Feed/Effluent Exchanger		Syngas from Shift Feed/Effluent Exchanger to Bulk Shift Reactor		Syngas from Bulk Shift Reactor to Sweep Gas Heater		Syngas from Sweep Gas Heater to Shift IP Steam Generator	
Stream Number		1		2		3		4		5	
Temperature, °C				207		288		453		352	
Pressure, bara				37.8		37.1		36.4		35.7	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	1,571	67.8%	2	0.0%	2	0.0%	2	0.0%	2	0.0%
H2O	18.02	0	0.0%	13,449	51.1%	13,449	51.1%	9,313	35.4%	9,313	35.4%
CO2	44.01	47	2.0%	673	2.6%	673	2.6%	4,809	18.3%	4,809	18.3%
H2	2.02	182	7.9%	7,010	26.6%	7,010	26.6%	11,145	42.3%	11,145	42.3%
N2	28.02	18	0.8%	35	0.1%	35	0.1%	35	0.1%	35	0.1%
CO	28.01	0	0.0%	5,131	19.5%	5,131	19.5%	995	3.8%	995	3.8%
H2S	34.08	2	0.1%	18	0.1%	18	0.1%	19	0.1%	19	0.1%
COS	60.07	0	0.0%	1	0.0%	1	0.0%	0	0.0%	0	0.0%
NH3	17.03	0	0.0%	3	0.0%	3	0.0%	3	0.0%	3	0.0%
AR	39.95	0	0.0%	8	0.0%	8	0.0%	8	0.0%	8	0.0%
C2H6	30.07	219	9.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
C3H8	44.09	172	7.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
C4H10	58.12	98	4.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
C5H12	72.14	8	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total kgmol/hr		2,318	100.0%	26,330	100.0%	26,330	100.0%	26,330	100.0%	26,330	100.0%
Total kg/hr (solids not included)		48,657		431,805		431,805		431,810		431,810	
Molecular Weight		21.00		16.40		16.40		16.40		16.40	
Density, kg/m3		28.3		16.1		13.3		9.8		11.3	
Liquid Flow, m3/hr		-		-		-		-		-	
Vapor Flow, m3/hr		1,717		26,820		32,467		44,062		38,213	
Solids, kg/hr		39,384		-		-		-		-	

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Table 7-1 – Heat and Material Balance (continued)

Stream Description		Syngas from Shift IP Steam Generator to Membrane Water Gas Shift Reactor		Retentate from Water Gas Shift Reactor to Shift Feed/Effluent Exchanger		Membrane Permeate to Low Temperature Gas Cooling		Retentate from Shift Feed/Effluent Exchanger to IP BFW Heater		Retentate from Shift IP BFW Heater to Retentate KO Drum #1	
Stream Number		6		7		8		9		10	
Temperature, °C		315		328		347		209		205	
Pressure, bara		35.0		35.0		3.0		34.3		33.6	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	2	0.0%	2	0.0%	0	0.0%	2	0.0%	2	0.0%
H2O	18.02	9,313	35.4%	8,333	56.3%	8,800	29.9%	8,333	56.3%	8,333	56.3%
CO2	44.01	4,809	18.3%	5,789	39.1%	0	0.0%	5,789	39.1%	5,789	39.1%
H2	2.02	11,145	42.3%	584	3.9%	11,541	39.2%	584	3.9%	584	3.9%
N2	28.02	35	0.1%	35	0.2%	9,100	30.9%	35	0.2%	35	0.2%
CO	28.01	995	3.8%	15	0.1%	0	0.0%	15	0.1%	15	0.1%
H2S	34.08	19	0.1%	19	0.1%	0	0.0%	19	0.1%	19	0.1%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	3	0.0%	3	0.0%	0	0.0%	3	0.0%	3	0.0%
AR	39.95	8	0.0%	8	0.1%	0	0.0%	8	0.1%	8	0.1%
Total kgmol/hr		26,330	100.0%	14,789	100.0%	29,441	100.0%	14,789	100.0%	14,789	100.0%
Total kg/hr		431,810		408,545		436,781		408,545		408,545	
Molecular Weight		16.40		27.63		14.84		27.63		27.63	
Density, kg/m3		11.6		20.0		0.9		25.6		25.6	
Liquid Flow, m3/hr		-		-		-		-		-	
Vapor Flow, m3/hr		36,594		20,427		485,313		15,959		15,959	

Table 7-1 – Heat and Material Balance (continued)

Stream Description		Retentate from Retentate KO Drum #1 to Retentate LP Steam Generator		Oxygen from Air Separation Unit to Gasification Island		Superheated IP Steam from Steam Turbine to Gasification and SARU		Stripped Water from Condensate Stripper to Syngas Scrubber		Sour Gas from Gasification Island to Hydrogen Rich Fuel Gas	
Stream Number		11		12		13		14		15	
Temperature, °C		206		207		379		127		49	
Pressure, bara		33.6		37.8		42.1		59.5		2.6	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	2	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2O	18.02	7,942	55.2%	0	0.0%	1,421	100.0%	8,232	100.0%	0	4.3%
CO2	44.01	5,789	40.2%	0	0.0%	0	0.0%	0	0.0%	1	34.8%
H2	2.02	584	4.1%	0	0.0%	0	0.0%	0	0.0%	1	39.1%
N2	28.02	35	0.2%	8	0.2%	0	0.0%	0	0.0%	0	0.0%
CO	28.01	15	0.1%	0	0.0%	0	0.0%	0	0.0%	0	17.4%
H2S	34.08	19	0.1%	0	0.0%	0	0.0%	0	0.0%	0	4.3%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
AR	39.95	6	0.1%	6	0.2%	0	0.0%	0	0.0%	0	0.0%
O2	32.00	0	0.0%	3,237	99.5%	0		0	0.0%	0	0.0%
Total kgmol/hr		14,396	100.0%	3,254	100.0%	1,421	100.0%	8,233	100.0%	2	100.0%
Total kg/hr		401,503		104,143		25,601		148,328		53	
Molecular Weight		27.89		32.01		18.02		18.02		23.23	
Density, kg/m3		25.6		63.2		15.0		692.1		2.3	
Liquid Flow, m3/hr		-		-		-		214		-	
Vapor Flow, m3/hr		15,711		1,648		1,711		-		23	

Table 7-1 – Heat and Material Balance (continued)

Stream Description		Saturated IP Steam from HRSG to Air Separation Unit		Nitrogen to Sweep Gas Heater		Saturated LP Steam to Air Separation Unit		Sweep Gas to Sweep Gas Heater		Sweep Gas from Sweep Gas Heater to Membrane Water Gas Shift Reactor	
Stream Number		16		17		18		19		20	
Temperature, °C		233		81		210		150		315	
Pressure, bara		29.6		4.5		4.1		4.1		3.0	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2O	18.02	293	100.0%	0	0.0%	8,800	100.0%	8,800	49.2%	8,800	49.2%
CO2	44.01	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2	2.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
N2	28.02	0	0.0%	9,100	100.0%	0	0.0%	9,100	50.8%	9,100	50.8%
CO	28.01	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2S	34.08	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
AR	39.95	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total kgmol/hr		293	100.0%	9,100	100.0%	8,800	100.0%	17,900	100.0%	17,900	100.0%
Total kg/hr		5,269		254,962		158,532		413,514		413,514	
Molecular Weight		18.02		28.02		18.02		23.10		23.10	
Density, kg/m3		14.8		2.3		1.9		2.7		1.4	
Liquid Flow, m3/hr		-		-		-		-		-	
Vapor Flow, m3/hr		356		110,862		83,436		153,153		295,367	

Table 7-1 – Heat and Material Balance (continued)

Stream Description		Condensate from Retentate KO Drum #1 to Stripped Condensate Drum		IP BFW to Shift IP BFW Heater		IP BFW from IP BFW Heater to IP Steam Drum		Steam from Shift IP Steam Drum		Blowdown from IP Steam Drum	
Stream Number		21		22		23		24		25	
Temperature, °C		206		151		197		234		234	
Pressure, bara		33.6		30.6		29.9		29.9		29.9	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2O	18.02	391	99.8%	1,022	100.0%	1,022	100.0%	1,002	100.0%	20	100.0%
CO2	44.01	1	0.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2	2.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
N2	28.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CO	28.01	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2S	34.08	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
AR	39.95	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total kgmol/hr		392	100.0%	1,022	100.0%	1,022	100.0%	1,002	100.0%	20	100.0%
Total kg/hr		7,075		18,402		18,402		18,042		360	
Molecular Weight		18.07		18.02		18.02		18.02		18.02	
Density, kg/m3		655.9		917.6		869.1		14.9		833.3	
Liquid Flow, m3/hr		8		20		21		-		0.4	
Vapor Flow, m3/hr		-		-		-		1,211		-	

Table 7-1 – Heat and Material Balance (continued)

Stream Description		Retentate to Retentate KO Drum #2		Retentate KO Drum #2 Overhead to Vacuum Condensate Heater		Retentate to Retentate KO Drum #3		Retentate KO Drum #3 Overhead to Retentate Trim Cooler		Retentate to Retentate KO Drum #4	
Stream Number		26		27		28		29		30	
Temperature, °C		162		162		52		52		35	
Pressure, bara		32.9		32.9		32.2		32.2		31.6	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	2	0.0%	2	0.0%	2	0.0%	2	0.0%	2	0.0%
H2O	18.02	7,942	55.2%	1,828	22.1%	1,828	22.1%	37	0.6%	37	0.6%
CO2	44.01	5,789	40.2%	5,767	69.8%	5,767	69.8%	5,752	89.2%	5,752	89.2%
H2	2.02	584	4.1%	584	7.1%	584	7.1%	584	9.0%	584	9.0%
N2	28.02	35	0.2%	35	0.4%	35	0.4%	35	0.5%	35	0.5%
CO	28.01	15	0.1%	15	0.2%	15	0.2%	15	0.2%	15	0.2%
H2S	34.08	19	0.1%	19	0.2%	19	0.2%	19	0.3%	19	0.3%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	3	0.0%	1	0.0%	1	0.0%	0	0.0%	0	0.0%
AR	39.95	8	0.1%	8	0.1%	8	0.1%	8	0.1%	8	0.1%
Total kgmol/hr		14,397	100.0%	8,259	100.0%	8,259	100.0%	6,450	100.0%	6,450	100.0%
Total kg/hr		401,470		290,333		290,333		257,336		257,336	
Molecular Weight		27.89		35.15		35.15		39.90		39.90	
Density, kg/m3		46.5		34.1		59.7		53.2		56.1	
Liquid Flow, m3/hr		-		-		-		-		-	
Vapor Flow, m3/hr		8,634		8,514		4,863		4,837		4,587	

Table 7-1 – Heat and Material Balance (continued)

Stream Description		CO2 Product from Low Temperature Gas Cooling		Permeate from Permeate LP Steam Generator to Permeate Air Cooler		Permeate from Permeate Air Cooler to Permeate KO Drum #1		Permeate from Permeate KO Drum #1 to Permeate Trim Cooler		Permeate to Permeate KO Drum #2	
Stream Number		31		32		33		34		35	
Temperature, °C		35		162		60		60		35	
Pressure, bara		31.6		2.9		2.7		2.7		2.6	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	2	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2O	18.02	16	0.3%	8,800	29.9%	8,800	29.9%	1,652	7.4%	1,652	7.4%
CO2	44.01	5,751	89.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2	2.02	584	9.1%	11,541	39.2%	11,541	39.2%	11,541	51.8%	11,541	51.8%
N2	28.02	35	0.5%	9,100	30.9%	9,100	30.9%	9,100	40.8%	9,100	40.8%
CO	28.01	15	0.2%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2S	34.08	19	0.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
AR	39.95	8	0.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total kgmol/hr		6,429	100.0%	29,441	100.0%	29,441	100.0%	22,293	100.0%	22,293	100.0%
Total kg/hr		256,953		436,781		436,781		308,005		308,005	
Molecular Weight		39.97		14.84		14.84		13.82		13.82	
Density, kg/m3		56.1		1.2		1.9		1.4		1.5	
Liquid Flow, m3/hr		-		-		-		-		-	
Vapor Flow, m3/hr		4,580		29,441		229,685		220,004		205,337	

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Table 7-1 – Heat and Material Balance (continued)

Stream Description		Permeate KO Drum #2 Overhead		Hydrogen Rich Fuel Gas to Existing Heaters/Boilers		Retentate KO Drum #2 Bottoms		Retentate KO Drum #3 Bottoms		Retentate KO Drum #4 Bottoms	
Stream Number		36		37		38		39		40	
Temperature, °C		40		41		162		52		35	
Pressure, bara		2.6		2.1		32.9		32.2		31.6	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2O	18.02	626	2.9%	711	3.3%	6,114	99.6%	1,792	99.0%	20	99.0%
CO2	44.01	0	0.0%	39	0.2%	21	0.3%	16	0.9%	0	1.0%
H2	2.02	11,541	54.3%	11,542	53.9%	0	0.0%	0	0.0%	0	0.0%
N2	28.02	9,100	42.6%	9,100	42.5%	0	0.0%	0	0.0%	0	0.0%
CO	28.01	0	0.0%	1	0.0%	0	0.0%	0	0.0%	0	0.0%
H2S	34.08	0	0.0%	1	0.0%	0	0.0%	0	0.0%	0	0.0%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	0	0.0%	3	0.0%	2	0.0%	1	0.1%	0	0.0%
AR	39.95	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total kgmol/hr		21,267	100.0%	21,396	100.0%	6,138	100.0%	1,809	100.0%	20	100.0%
Total kg/hr		289,520		292,860		111,133		33,001		373	
Molecular Weight		13.61		13.69		18.10		18.24		18.27	
Density, kg/m3		1.4		1.1		900.9		967.3		969.4	
Liquid Flow, m3/hr		-		-		123		34		0.4	
Vapor Flow, m3/hr		206,800		270,141		-		-		-	

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Table 7-1 – Heat and Material Balance (continued)

Stream Description		Condensate to Stripper Feed Drum		Permeate KO Drum #1 Bottoms		Permeate Condensate Drum Bottoms to Permeate Condensate Pump		Permeate Condensate from Permeate Condensate Pump		Vacuum Condensate from Vacuum Condensate Pump	
Stream Number		41		42		43		44		45	
Temperature, °C		137		60		40		40		41	
Pressure, bara		31.6		2.7		2.6		10.3		10.3	
Component Flows	MW	kgmol/hr	mol.%	kgmol/hr	mol.%	kgmol/hr	mol.%	kgmol/hr	mol.%	kgmol/hr	mol.%
CH4	16.04	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2O	18.02	7,926	99.5%	7,148	100.0%	8,174	100.0%	8,174	100.0%	5,489	100.0%
CO2	44.01	37	0.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2	2.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
N2	28.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CO	28.01	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2S	34.08	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	3	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
AR	39.95	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total kgmol/hr		7,968	100.0%	7,148	100.0%	8,175	100.0%	8,175	100.0%	5,489	100.0%
Total kg/hr		144,515		128,776		147,261		147,261		98,886	
Molecular Weight		18.14		18.01		18.01		18.01		18.02	
Density, kg/m3		892.9		983.2		992.1		992.5		992.5	
Liquid Flow, m3/hr		162		130.98		148		148		100	
Vapor Flow, m3/hr		-		-		-		-		-	

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Table 7-1 – Heat and Material Balance (continued)

Stream Description		Vacuum Condensate to Vacuum Condensate Heater		Vacuum Condensate from Vacuum Condensate Heater to Deaerator		Stripper Overhead from Stripper Reflux Drum		LP BFW from Deaerator		LP BFW from Deaerator to Permeate LP Steam Drum	
Stream Number		46		47		48		49		50	
Temperature, °C		40		148						142	
Pressure, bara		10.3		9.7						4.9	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	0	0.0%	0	0.0%	0	0.5%	0	0.0%	0	0.0%
H2O	18.02	13,663	100.0%	13,663	100.0%	18	30.2%	11,110	100.0%	4,510	100.0%
CO2	44.01	0	0.0%	0	0.0%	37	62.3%	0	0.0%	0	0.0%
H2	2.02	0	0.0%	0	0.0%	0	0.5%	0	0.0%	0	0.0%
N2	28.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CO	28.01	0	0.0%	0	0.0%	0	0.4%	0	0.0%	0	0.0%
H2S	34.08	0	0.0%	0	0.0%	0	0.6%	0	0.0%	0	0.0%
COS	60.07	0	0.0%	0	0.0%	0	0.1%	0	0.0%	0	0.0%
NH3	17.03	0	0.0%	0	0.0%	3	4.9%	0	0.0%	0	0.0%
AR	39.95	0	0.0%	0	0.0%	0	0.5%	0	0.0%	0	0.0%
Total kgmol/hr		13,664	100.0%	13,664	100.0%	60	100.0%	11,110	100.0%	4,510	100.0%
Total kg/hr		246,148		246,153		2,047		200,141		81,255	
Molecular Weight		18.01		18.02		34.35		18.02		18.02	
Density, kg/m3		992.5		918.9		2.4		924.4		924.4	
Liquid Flow, m3/hr		248		268		-		217		88	
Vapor Flow, m3/hr		-		-		857		-		-	

Table 7-1 – Heat and Material Balance (continued)

Stream Description		LP BFW from Deaerator to Retentate LP Steam Drum		Saturated LP Steam to HRSG LP Superheater		LP Blowdown from Retentate LP Steam Drum		LP Saturated Steam from Permeate LP Steam Drum		LP Blowdown to Blowdown Drum	
Stream Number		51		52		53		54		55	
Temperature, °C		142		151		151		151		151	
Pressure, bara		4.9		4.8		4.8		4.8		4.8	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2O	18.02	6,599	100.0%	6,470	100.0%	129	100.0%	4,366	100.0%	144	100.0%
CO2	44.01	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2	2.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
N2	28.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CO	28.01	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2S	34.08	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
AR	39.95	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total kgmol/hr		6,599	100.0%	6,470	100.0%	129	100.0%	4,366	100.0%	144	100.0%
Total kg/hr		118,886		116,555		2,331		78,659		2,596	
Molecular Weight		18.02		18.02		18.02		18.02		18.02	
Density, kg/m3		924.4		2.6		916.3		2.5		916.2	
Liquid Flow, m3/hr		129		-		3		-		3	
Vapor Flow, m3/hr		-		44,829		-		31,464		-	

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Table 7-1 – Heat and Material Balance (continued)

Stream Description		Stripper Feed Drum Bottoms to Condensate Stripper		Stripper Feed Drum Overhead to Stripper Condenser		Condensate Stripper Overhead to Overhead Condenser		Condensate Stripper Overhead from Condenser to Overhead Accumulator		Condensate Stripper Reflux Drum Overhead to Hydrogen Rich Fuel Gas Stream	
Stream Number		56		57		58		59		60	
Temperature, °C		129		129		121		88		88	
Pressure, bara		3.4		3.4		2.2		2.1		2.1	
Component Flows	MW	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %	kgmol/hr	mol %
CH4	16.04	0	0.0%	0	0.1%	0.4	0.0%	0.4	0.0%	0.3	0.5%
H2O	18.02	7,809	99.9%	117	76.5%	1,001.3	91.3%	1,001.3	91.3%	18.0	30.2%
CO2	44.01	3	0.0%	35	22.5%	56.1	5.1%	56.1	5.1%	37.2	62.4%
H2	2.02	0	0.0%	0	0.2%	0.3	0.0%	0.3	0.0%	0.3	0.5%
N2	28.02	0	0.0%	0	0.0%	0.0	0.0%	0.0	0.0%	0.0	0.0%
CO	28.01	0	0.0%	0	0.1%	0.2	0.0%	0.2	0.0%	0.2	0.3%
H2S	34.08	0	0.0%	0	0.2%	0.4	0.0%	0.4	0.0%	0.4	0.7%
COS	60.07	0	0.0%	0	0.0%	0.1	0.0%	0.1	0.0%	0.0	0.0%
NH3	17.03	3	0.0%	0	0.1%	37.2	3.4%	37.2	3.4%	2.9	4.9%
AR	39.95	0	0.0%	0	0.1%	0.3	0.0%	0.3	0.0%	0.3	0.5%
Total kgmol/hr		7,815	100.0%	153	100.0%	1,096	100.0%	1,096	100.0%	60	100.0%
Total kg/hr		140,852		3,659		21,185		21,185		2,047	
Molecular Weight		18.02		23.91		19.32		19.32		34.35	
Density, kg/m3		935.0		2.5		1.3		12.6		2.4	
Liquid Flow, m3/hr		151		-		-		20		-	
Vapor Flow, m3/hr		-		1,464		15		930		853	

Table 7-1 – Heat and Material Balance (continued)

Stream Description		Condensate Stripper Reflux from Reflux Pump		Condensate Stripper Bottoms to Stripped Condensate Drum		Condensate Stripper Bottoms to Stripper Reboiler		Condensate Stripper Boilup		Stripped Condensate Drum Bottoms to Stripped Condensate Pump	
Stream Number		61		62		63		64		65	
Temperature, °C		88		126		126		126		126	
Pressure, bara		2.2		2.4		2.4		2.4		2.4	
Component Flows	MW	kgmol/hr	mol.%	kgmol/hr	mol.%	kgmol/hr	mol.%	kgmol/hr	mol.%	kgmol/hr	mol.%
CH4	16.04	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2O	18.02	983	94.8%	7,906	100.0%	973	100.0%	973	100.0%	8,232	100.0%
CO2	44.01	19	1.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2	2.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
N2	28.02	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
CO	28.01	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
H2S	34.08	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
COS	60.07	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
NH3	17.03	34	3.3%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
AR	39.95	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total kgmol/hr		1,037	100.0%	7,906	100.0%	973	100.0%	973	100.0%	8,232	100.0%
Total kg/hr		19,138		142,468		17,530		17,530		148,317	
Molecular Weight		18.46		18.01		18.01		18.01		18.02	
Density, kg/m3		986.9		937.6		937.6		1.3		937.9	
Liquid Flow, m3/hr		19.39		152		19		-		158	
Vapor Flow, m3/hr		-		-		-		13,485		-	