

SECTION 20 NORMAL CASE 100% capacity , No Hot Steam Stand-By Operation									Page 1
Stream	101	102	103	104	105	113	200	201	203
Description	CG from furnaces	Water recycle to T201	Tar water to OSBL	Water from D302 / E309	Light oil from D 203	CG to C 301	QW to P 201	Water to D 201	S 203 purge
Phase	Vapor	Liquid	Liquid	Liquid	Liquid	Vapor	Liquid	Liquid	Liquid
Vapour Fraction (wt%)	100.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Temperature (°C)	162.0	73.4	79.0	39.2	79.0	40.0	79.0	79.0	79.0
Pressure (bar g)	0.59	0.56	2.00	0.56	3.55	0.50	0.56	0.56	7.51
Mass Flow (kg/h)	164930	66416	900	9407	100	128916	794634	46795	57009
Molar Flow (kgmole/h)	8934.1	3686.7	49.9	522.2	0.5	6940.1	44105.6	2594.0	3163.7
Molecular Weight	18.46	18.02	18.02	18.02	208.45	18.58	18.02	18.04	18.02
Mass Density (kg/m3)	0.81	977.06	973.80	990.95	920.00	1.07	973.40	973.40	974.30
Actual Volume Flow (m3/h)	202911	68	1	9	0.1	120016	816	48	58.5
Enthalpy (kW)	-148149	-288940	-3531	-41262	-57	-27352	-3448527	-203079	-247406
Vapour Phase									
Molar Flow (kgmole/h)	8934.1	-	-	-	-	6940.1	-	-	-
Mass Flow (kg/h)	164930	-	-	-	-	128916	-	-	-
Actual Volume Flow (m3/h)	202911	-	-	-	-	120016	-	-	-
Normal Volume Flow (Nm3/h)	200249	-	-	-	-	155555	-	-	-
Molecular Weight	18.46	-	-	-	-	18.58	-	-	-
Mass Density (kg/m3)	0.81	-	-	-	-	1.07	-	-	-
Viscosity (cP)	0.015	-	-	-	-	0.012	-	-	-
Specific heat (kJ/kg°C)	2.449	-	-	-	-	2.196	-	-	-
Thermal Conductivity (W/m°C)	0.064	-	-	-	-	0.053	-	-	-
Cp/Cv	1.23	-	-	-	-	1.26	-	-	-
Compressibility factor (Z)	0.998	-	-	-	-	0.996	-	-	-
HC Liquid Phase									
Molar Flow (kgmole/h)	-	-	-	-	0.48	-	-	0.48	-
Mass Flow (kg/h)	-	-	-	-	99.5	-	-	99.5	-
Actual Volume Flow (m3/h)	-	-	-	-	0.1	-	-	0.1	-
Molecular Weight	-	-	-	-	208.45	-	-	208.45	-
Mass Density (kg/m3)	-	-	-	-	920.0	-	-	920.0	-
Viscosity (cP)	-	-	-	-	1.974	-	-	1.974	-
Specific heat (kJ/kg°C)	-	-	-	-	1.111	-	-	1.111	-
Thermal Conductivity (W/m°C)	-	-	-	-	0.192	-	-	0.192	-
Surface Tension (dyne/cm)	-	-	-	-	37.7	-	-	37.7	-
Aqueous Phase									
Mass Flow (kg/h)	-	66416.0	900.0	9406.7	-	-	794634.0	46695.5	57009.0
Composition (wt%)									
Water	25.49	100.00	100.00	100.00	0.03	4.75	100.00	99.79	100.00
Hydrogen	2.97	0.00	0.00	0.00	0.00	3.80	0.00	0.00	0.00
Methane	3.90	0.00	0.00	0.00	0.00	4.99	0.00	0.00	0.00
CO	0.08	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
CO2	0.03	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
H2S	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Acetylene	0.28	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00
Ethylene	38.50	0.00	0.00	0.00	0.03	49.25	0.00	0.00	0.00
Ethane	25.13	0.00	0.00	0.00	0.03	32.15	0.00	0.00	0.00
MAPD	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
Propylene	0.86	0.00	0.00	0.00	0.00	1.10	0.00	0.00	0.00
Propane	0.18	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00
C4's	1.36	0.00	0.00	0.00	0.01	1.75	0.00	0.00	0.00
C5+	1.19	0.00	11.05	0.00	99.90	1.45	0.00	0.21	0.00
Composition (mol%)									
Water	26.12	100.00	100.00	100.00	0.31	4.90	100.00	99.98	100.00
Hydrogen	27.17	0.00	0.00	0.00	0.01	34.98	0.00	0.00	0.00
Methane	4.49	0.00	0.00	0.00	0.01	5.78	0.00	0.00	0.00
CO	0.05	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00
CO2	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Acetylene	0.20	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00
Ethylene	25.33	0.00	0.00	0.00	0.22	32.61	0.00	0.00	0.00
Ethane	15.43	0.00	0.00	0.00	0.19	19.86	0.00	0.00	0.00
MAPD	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Propylene	0.38	0.00	0.00	0.00	0.01	0.48	0.00	0.00	0.00
Propane	0.08	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
C4's	0.46	0.00	0.00	0.00	0.04	0.59	0.00	0.00	0.00
C5+	0.27	0.00	0.00	0.00	99.19	0.34	0.00	0.02	0.00
Updated	09 / 07 / 2004		D. Martinez Padrino		J-F. Fournier		Y. Simon		1
Issue for design	09 / 04 / 2004		D. Martinez Padrino		C. Bagland		J-F. Fournier		0
Status	Date		Written by		Checked by		Approved by		Rev.
Document revisions									

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Stream	204	205	206	207	208	209	210	211	212
Description	Water from D 202	QW from S 203	DS to T 202	Sour water from D 203	Steam from T 202	Process water to D 204	DS from D 204	DS from E 206	DS blowdown from D 204
Phase	Liquid	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid
Vapour Fraction (wt%)	0.0	0.0	100.0	0.0	100.0	0.0	100.0	100.0	0.0
Temperature (°C)	79.0	79.0	190.0	79.0	116.1	117.7	169.1	190.0	169.1
Pressure (bar g)	0.56	7.51	6.25	3.55	0.75	6.75	6.75	6.25	6.75
Mass Flow (kg/h)	57009	737625	4523	45795	1374	48944	46657	46657	5857
Molar Flow (kgmole/h)	3163.7	40933.7	251.1	2541.3	76.3	2716.8	2589.9	2589.9	325.1
Molecular Weight	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02
Mass Density (kg/m3)	973.40	974.30	3.55	974.00	1.00	944.70	4.04	3.55	897.97
Actual Volume Flow (m3/h)	59	757	1275	47	1379	52	11556	13150	7
Enthalpy (kW)	-247481	-3196201	-16465	-198377	-5047	-209792	-170541	-169845	-24745
Vapour Phase									
Molar Flow (kgmole/h)	-	-	251.1	-	76.3	-	2589.9	2589.9	-
Mass Flow (kg/h)	-	-	4523	-	1374	-	46657	46657	-
Actual Volume Flow (m3/h)	-	-	1275	-	1379	-	11556	13150	-
Normal Volume Flow (Nm3/h)	-	-	5627	-	1709	-	58050	58050	-
Molecular Weight	-	-	18.02	-	18.02	-	18.02	18.02	-
Mass Density (kg/m3)	-	-	3.55	-	1.00	-	4.04	3.55	-
Viscosity (cP)	-	-	0.016	-	0.013	-	0.015	0.016	-
Specific heat (kJ/kg°C)	-	-	2.325	-	2.100	-	2.483	2.325	-
Thermal Conductivity (W/m°C)	-	-	0.034	-	0.026	-	0.030	0.034	-
Cp/Cv	-	-	1.37	-	1.35	-	1.40	1.37	-
Compressibility factor (Z)	-	-	0.956	-	0.978	-	0.940	0.956	-
HC Liquid Phase									
Molar Flow (kgmole/h)	-	-	-	-	-	-	-	-	-
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Actual Volume Flow (m3/h)	-	-	-	-	-	-	-	-	-
Molecular Weight	-	-	-	-	-	-	-	-	-
Mass Density (kg/m3)	-	-	-	-	-	-	-	-	-
Viscosity (cP)	-	-	-	-	-	-	-	-	-
Specific heat (kJ/kg°C)	-	-	-	-	-	-	-	-	-
Thermal Conductivity (W/m°C)	-	-	-	-	-	-	-	-	-
Surface Tension (dyne/cm)	-	-	-	-	-	-	-	-	-
Aqueous Phase									
Mass Flow (kg/h)	57009.0	737625.0	-	45794.7	-	48943.7	-	-	5856.7
Composition (wt%)									
Water	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol%)									
Water	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Document revisions									
Updated	09 / 07 / 2004	D. Martinez Padrino		J-F. Fournier		Y. Simon		1	
Issue for design	09 / 04 / 2004	D. Martinez Padrino		C. Bagland		J-F. Fournier		0	
Status	Date	Written by		Checked by		Approved by		Rev.	

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HOT STEAM STAND-BY										1
100% capacity , Hot Steam Stand-By Operation										
Stream	101	102	103	104	105	113	200	201	203	
Description	CG from furnaces	Water recycle to T201	Tar water to OSBL	Water from D302 / E309	Light oil from D 203	CG to C 301	QW to P 201	Water to D 201	S 203 purge	
Phase	Vapor	Liquid	Liquid	Liquid	Liquid	Vapor	Liquid	Liquid	Liquid	
Vapour Fraction (wt%)	100.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	
Temperature (°C)	160.8	73.4	79.0	39.2	79.0	40.0	79.0	79.0	79.0	
Pressure (bar g)	0.59	0.56	2.00	0.56	3.55	0.50	0.56	0.56	7.51	
Mass Flow (kg/h)	188755	66474	900	9407	100	128916	1140172	71357	57009	
Molar Flow (kgmole/h)	10256.6	3688.9	49.9	522.2	0.5	6940.1	63289.8	3955.9	3164.5	
Molecular Weight	18.40	18.02	18.02	18.02	208.45	18.58	18.02	18.04	18.02	
Mass Density (kg/m3)	0.81	977.06	973.80	990.95	920.00	1.07	973.40	973.40	974.30	
Actual Volume Flow (m3/h)	232160	68	1	9	0.1	120016	1171	73	59	
Enthalpy (kW)	-235353	-288940	-3531	-41262	-57	-27352	-4948487	-309321	-247426	
Vapour Phase										
Molar Flow (kgmole/h)	10256.6	-	-	-	-	6940.1	-	-	-	
Mass Flow (kg/h)	188755	-	-	-	-	128916	-	-	-	
Actual Volume Flow (m3/h)	232160	-	-	-	-	120016	-	-	-	
Normal Volume Flow (Nm3/h)	229892	-	-	-	-	155555	-	-	-	
Molecular Weight	18.40	-	-	-	-	18.58	-	-	-	
Mass Density (kg/m3)	0.81	-	-	-	-	1.07	-	-	-	
Viscosity (cP)	0.014	-	-	-	-	0.012	-	-	-	
Specific heat (kJ/kg°C)	2.386	-	-	-	-	2.196	-	-	-	
Thermal Conductivity (W/m°C)	0.059	-	-	-	-	0.053	-	-	-	
Cp/Cv	1.24	-	-	-	-	1.26	-	-	-	
Compressibility factor (Z)	0.998	-	-	-	-	0.996	-	-	-	
HC Liquid Phase										
Molar Flow (kgmole/h)	-	-	-	-	0.48	-	-	0.48	-	
Mass Flow (kg/h)	-	-	-	-	99.5	-	-	99.5	-	
Actual Volume Flow (m3/h)	-	-	-	-	0.1	-	-	0.1	-	
Molecular Weight	-	-	-	-	208.45	-	-	208.45	-	
Mass Density (kg/m3)	-	-	-	-	920.0	-	-	920.0	-	
Viscosity (cP)	-	-	-	-	1.974	-	-	1.974	-	
Specific heat (kJ/kg°C)	-	-	-	-	1.111	-	-	1.111	-	
Thermal Conductivity (W/m°C)	-	-	-	-	0.192	-	-	0.192	-	
Surface Tension (dyne/cm)	-	-	-	-	37.7	-	-	37.7	-	
Aqueous Phase										
Mass Flow (kg/h)	-	66473.7	900.0	9406.7	-	-	1140172.0	71257.0	57009.0	
Composition (wt%)										
Water	34.89	100.00	100.00	100.00	0.03	4.75	100.00	99.86	100.00	
Hydrogen	2.59	0.00	0.00	0.00	0.00	3.80	0.00	0.00	0.00	
Methane	3.41	0.00	0.00	0.00	0.00	4.99	0.00	0.00	0.00	
CO	0.07	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	
CO2	0.03	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	
H2S	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	
Acetylene	0.25	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00	
Ethylene	33.64	0.00	0.00	0.00	0.03	49.25	0.00	0.00	0.00	
Ethane	21.96	0.00	0.00	0.00	0.03	32.15	0.00	0.00	0.00	
MAPD	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	
Propylene	0.75	0.00	0.00	0.00	0.00	1.10	0.00	0.00	0.00	
Propane	0.16	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	
C4's	1.19	0.00	0.00	0.00	0.01	1.75	0.00	0.00	0.00	
C5+	1.04	0.00	0.00	0.00	99.90	1.45	0.00	0.14	0.00	
Composition (mol%)										
Water	35.64	100.00	100.00	100.00	0.31	4.90	100.00	99.99	100.00	
Hydrogen	23.67	0.00	0.00	0.00	0.01	34.98	0.00	0.00	0.00	
Methane	3.91	0.00	0.00	0.00	0.01	5.78	0.00	0.00	0.00	
CO	0.05	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	
CO2	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	
H2S	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	
Acetylene	0.17	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	
Ethylene	22.07	0.00	0.00	0.00	0.22	32.61	0.00	0.00	0.00	
Ethane	13.44	0.00	0.00	0.00	0.19	19.86	0.00	0.00	0.00	
MAPD	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	
Propylene	0.33	0.00	0.00	0.00	0.01	0.48	0.00	0.00	0.00	
Propane	0.07	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	
C4's	0.40	0.00	0.00	0.00	0.04	0.59	0.00	0.00	0.00	
C5+	0.24	0.00	0.00	0.00	99.19	0.34	0.00	0.01	0.00	
Document revisions										
Updated	09 / 07 / 2004		D. Martinez Padrino		J-F. Fournier		Yvon Simon		1	
Issue for design	09 / 04 / 2003		D. Martinez Padrino		C. Bagland		J-F. Fournier		0	
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HOT STEAM STAND-BY									2
100% capacity , Hot Steam Stand-By Operation									
Stream	204	205	206	207	208	209	210	211	212
Description	Water from D 202	QW from S 203	DS to T 202	Sour water from D 203	Steam from T 202	Process water to D 204	DS from D 204	DS from E 206	DS blowdown from D 204
Phase	Liquid	Liquid	Vapor	Liquid	Vapor	Liquid	Vapor	Vapor	Liquid
Vapour Fraction (wt%)	0.0	0.0	100.0	0.0	100.0	0.0	100.0	100.0	0.0
Temperature (°C)	79.0	79.0	190.0	79.0	116.1	117.7	169.1	190.0	169.1
Pressure (bar g)	0.56	7.51	6.25	3.55	0.75	6.75	6.75	6.25	6.75
Mass Flow (kg/h)	57009	1083163	6949	70357	2111	75195	72908	72908	6163
Molar Flow (kgmole/h)	3164.5	60125.3	385.7	3905.4	117.2	4174.0	4047.0	4047.0	342.1
Molecular Weight	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02	18.02
Mass Density (kg/m3)	973.40	974.30	3.55	972.05	1.00	944.70	4.04	3.55	897.96
Actual Volume Flow (m3/h)	59	1112	1958	72	2118	80	18057	20548	7
Enthalpy (kW)	-247426	-4701061	-25295	-304776	-7754	-322313	-266493	-265407	-26038
Vapour Phase									
Molar Flow (kgmole/h)	-	-	385.7	-	117.2	-	4047.0	4047.0	-
Mass Flow (kg/h)	-	-	6949	-	2111	-	72908	72908	-
Actual Volume Flow (m3/h)	-	-	1958	-	2118	-	18057	20548	-
Normal Volume Flow (Nm3/h)	-	-	8645	-	2626	-	90711	90711	-
Molecular Weight	-	-	18.02	-	18.02	-	18.02	18.02	-
Mass Density (kg/m3)	-	-	3.55	-	1.00	-	4.04	3.55	-
Viscosity (cP)	-	-	0.016	-	0.013	-	0.015	0.016	-
Specific heat (kJ/kg°C)	-	-	2.325	-	2.100	-	2.483	2.325	-
Thermal Conductivity (W/m°C)	-	-	0.034	-	0.026	-	0.030	0.034	-
Cp/Cv	-	-	1.37	-	1.35	-	1.40	1.37	-
Compressibility factor (Z)	-	-	0.956	-	0.978	-	0.940	0.956	-
HC Liquid Phase									
Molar Flow (kgmole/h)	-	-	-	-	-	-	-	-	-
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Actual Volume Flow (m3/h)	-	-	-	-	-	-	-	-	-
Molecular Weight	-	-	-	-	-	-	-	-	-
Mass Density (kg/m3)	-	-	-	-	-	-	-	-	-
Viscosity (cP)	-	-	-	-	-	-	-	-	-
Specific heat (kJ/kg°C)	-	-	-	-	-	-	-	-	-
Thermal Conductivity (W/m°C)	-	-	-	-	-	-	-	-	-
Surface Tension (dyne/cm)	-	-	-	-	-	-	-	-	-
Aqueous Phase									
Mass Flow (kg/h)	57009.0	1083163.0	-	70356.5	-	75194.6	-	-	6162.6
Composition (wt%)									
Water	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol%)									
Water	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Document revisions									
	09 / 07 / 2004	D. Martinez Padrino	J-F. Fournier	Yvon Simon	1				
Issue for design	09 / 04 / 2003	D. Martinez Padrino	C. Bagland	J-F. Fournier	0				
Status	Date	Written by	Checked by	Approved by	Rev.				

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SECTION 30 NORMAL CASE 100% capacity									Page
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Stream	113	302	303	304	305	306	308	309	310
Description	CG from T 201	CG to E 301	CG from E 301	CG from D 302	Light oil from D 302	Water from D 302	CG to E 302	CG from E 302	CG from D 303
Phase	Vapor	Vapor	Mixed	Vapor	Liquid	Liquid	Vapor	Mixed	Vapor
Vapour Fraction (wt%)	100.0	100.0	98.4	100.0	0.0	0.0	100.0	97.7	100.0
Temperature (°C)	40.0	95.0	45.0	44.5	37.9	39.2	95.0	45.0	44.9
Pressure (bar g)	0.50	1.93	1.73	1.63	1.63	1.63	4.33	4.13	4.08
Mass Flow (kg/h)	128916	129186	129186	127184	304	9407	127994	127994	125087
Molar Flow (kgmole/h)	6940.1	6955.1	6955.1	6844.3	3.1	522.2	6889.2	6889.2	6728.6
Molecular Weight	18.58	18.57	18.57	18.58	97.74	18.02	18.58	18.58	18.59
Mass Density (kg/m3)	1.07	1.79	1.96	1.86	916.71	996.66	3.26	3.73	3.61
Actual Volume Flow (m3/h)	120019	72363	65872	68316	0	9	39271	34293	34624
Enthalpy (kW)	-27351	-23881	-29361	-20605	30	-41262	-19551	-25583	-12886
Vapour Phase									
Molar Flow (kgmole/h)	6940.1	6955.1	6841.1	6844.3	-	-	6889.2	6727.7	6728.6
Mass Flow (kg/h)	128916	129186	127126	127184	-	-	127994	125068	125087
Actual Volume Flow (m3/h)	120019	72363	65870	68316	-	-	39271	34290	34624
Normal Volume Flow (Nm3/h)	155555	155891	153337	153407	-	-	154415	150795	150814
Molecular Weight	18.58	18.57	18.58	18.58	-	-	18.58	18.59	18.59
Mass Density (kg/m3)	1.07	1.79	1.93	1.86	-	-	3.26	3.65	3.61
Viscosity (cP)	0.012	0.014	0.012	0.012	-	-	0.014	0.012	0.012
Specific heat (kJ/kg°C)	2.196	2.375	2.223	2.220	-	-	2.387	2.240	2.240
Thermal Conductivity (W/m°C)	0.053	0.062	0.054	0.054	-	-	0.063	0.055	0.055
Cp/Cv	1.26	1.24	1.26	1.26	-	-	1.24	1.27	1.27
Compressibility factor (Z)	0.996	0.996	0.994	0.994	-	-	0.993	0.988	0.989
HC Liquid Phase									
Molar Flow (kgmole/h)	-	-	0.05	-	3.11	-	-	0.11	-
Mass Flow (kg/h)	-	-	8.7	-	303.6	-	-	19.0	-
Actual Volume Flow (m3/h)	-	-	0.0	-	0.3	-	-	0.0	-
Molecular Weight	-	-	192.19	-	97.74	-	-	177.65	-
Mass Density (kg/m3)	-	-	1096.5	-	916.7	-	-	1086.4	-
Viscosity (cP)	-	-	3.176	-	0.674	-	-	2.619	-
Specific heat (kJ/kg°C)	-	-	1.014	-	1.641	-	-	1.083	-
Thermal Conductivity (W/m°C)	-	-	0.189	-	0.136	-	-	0.180	-
Surface Tension (dyne/cm)	-	-	39.4	-	27.8	-	-	38.0	-
Aqueous Phase									
Mass Flow (kg/h)	-	-	2052.1	-	-	9406.7	-	2907.5	-
Composition (wt %)									
Water	4.75	4.95	4.95	3.46	0.01	100.00	4.07	4.07	1.84
Hydrogen	3.80	3.79	3.79	3.85	0.00	0.00	3.82	3.82	3.91
Methane	4.99	4.98	4.98	5.06	0.00	0.00	5.03	5.03	5.15
CO	0.10	0.10	0.10	0.10	0.00	0.00	0.10	0.10	0.11
CO2	0.04	0.04	0.04	0.04	0.00	0.00	0.04	0.04	0.04
H2S	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01
Acetylene	0.36	0.36	0.36	0.37	0.01	0.00	0.36	0.36	0.37
Ethylene	49.25	49.15	49.15	49.92	0.30	0.00	49.61	49.61	50.76
Ethane	32.15	32.08	32.08	32.59	0.56	0.00	32.38	32.38	33.14
MAPD	0.02	0.02	0.02	0.02	0.02	0.00	0.02	0.02	0.02
Propylene	1.10	1.10	1.10	1.11	0.26	0.00	1.11	1.11	1.13
Propane	0.24	0.24	0.24	0.24	0.06	0.00	0.24	0.24	0.24
C4's	1.75	1.74	1.74	1.77	2.75	0.00	1.76	1.76	1.80
C5+	1.45	1.45	1.45	1.46	96.04	0.00	1.45	1.45	1.47
Composition (mol %)									
Water	4.90	5.10	5.10	3.56	0.07	100.00	4.19	4.19	1.90
Hydrogen	34.98	34.90	34.90	35.47	0.00	0.00	35.24	35.24	36.08
Methane	5.78	5.77	5.77	5.86	0.00	0.00	5.83	5.83	5.96
CO	0.07	0.07	0.07	0.07	0.00	0.00	0.07	0.07	0.07
CO2	0.02	0.02	0.02	0.02	0.00	0.00	0.02	0.02	0.02
H2S	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01
Acetylene	0.26	0.26	0.26	0.26	0.03	0.00	0.26	0.26	0.27
Ethylene	32.61	32.54	32.54	33.07	1.05	0.00	32.85	32.85	33.64
Ethane	19.86	19.82	19.82	20.14	1.81	0.00	20.01	20.01	20.49
MAPD	0.01	0.01	0.01	0.01	0.04	0.00	0.01	0.01	0.01
Propylene	0.48	0.48	0.48	0.49	0.60	0.00	0.49	0.49	0.50
Propane	0.10	0.10	0.10	0.10	0.13	0.00	0.10	0.10	0.10
C4's	0.59	0.59	0.59	0.60	4.90	0.00	0.59	0.59	0.61
C5+	0.34	0.34	0.34	0.35	91.37	0.00	0.34	0.34	0.35
Document revisions									
Updated	09 / 07 / 2004	D. Martinez Padrino		J-F. Fournier		Yvon Simon		1	
Issue for design	09 / 04 / 2004	D. Martinez Padrino		C. Bagland		J-F. Fournier		0	
Status	Date	Written by		Checked by		Approved by		Rev.	

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SECTION 30 NORMAL CASE 100% capacity									Page
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Stream	311	313	314	315	315a	316	318	320	321
Description	Liquid from D 303	CG to E 303	CG from E 303	C 301 4th stg. suction	CG from D 304	Liquid from D 304	CG to E 304	CG from E 304	CG from D 305
Phase	Liquid	Vapor	Mixed	Vapor	Vapor	Liquid	Vapor	Mixed	Vapor
Vapour Fraction (wt%)	0.0	100.0	98.4	100.0	100.0	0.0	100.0	99.5	100.0
Temperature (°C)	37.8	95.0	45.0	44.2	45.0	33.4	95.0	45.0	45.0
Pressure (bar g)	4.08	9.31	9.06	9.01	9.01	9.01	17.94	17.57	17.52
Mass Flow (kg/h)	7708	125912	125912	141486	123957	4802	141746	141746	141053
Molar Flow (kgmole/h)	414.4	6774.4	6774.4	7540.8	6666.5	253.8	7555.2	7555.2	7516.9
Molecular Weight	18.60	18.59	18.59	18.76	18.59	18.92	18.76	18.76	18.76
Mass Density (kg/m3)	993.67	6.35	7.35	7.28	7.20	992.31	11.91	13.81	13.70
Actual Volume Flow (m3/h)	8	19838	17141	19422	17224	5	11906	10266	10294
Enthalpy (kW)	-32476	-12004	-17378	-15121	-8871	-19779	-11676	-16764	-13716
Vapour Phase									
Molar Flow (kgmole/h)	-	6774.4	6666.3	7540.8	6666.5	-	7555.2	7516.5	7516.9
Mass Flow (kg/h)	-	125912	123954	141486	123957	-	141746	141043	141053
Actual Volume Flow (m3/h)	-	19838	17139	19422	17224	-	11906	10265	10294
Normal Volume Flow (Nm3/h)	-	151841	149419	169020	149423	-	169343	168475	168484
Molecular Weight	-	18.59	18.59	18.76	18.59	-	18.76	18.76	18.76
Mass Density (kg/m3)	-	6.35	7.23	7.28	7.20	-	11.91	13.74	13.70
Viscosity (cP)	-	0.014	0.012	0.012	0.012	-	0.014	0.013	0.013
Specific heat (kJ/kg°C)	-	2.412	2.269	2.243	2.268	-	2.424	2.294	2.294
Thermal Conductivity (W/m°C)	-	0.064	0.056	0.053	0.056	-	0.063	0.054	0.054
Cp/Cv	-	1.25	1.28	1.28	1.28	-	1.27	1.31	1.31
Compressibility factor (Z)	-	0.986	0.978	0.977	0.978	-	0.975	0.959	0.959
HC Liquid Phase									
Molar Flow (kgmole/h)	3.19	-	0.09	-	-	3.38	-	0.04	-
Mass Flow (kg/h)	299.5	-	13.4	-	-	290.1	-	5.7	-
Actual Volume Flow (m3/h)	0.3	-	0.0	-	-	0.3	-	0.0	-
Molecular Weight	93.81	-	153.72	-	-	85.81	-	133.54	-
Mass Density (kg/m3)	901.4	-	1061.7	-	-	871.3	-	1030.0	-
Viscosity (cP)	0.609	-	1.842	-	-	0.514	-	1.312	-
Specific heat (kJ/kg°C)	1.675	-	1.219	-	-	1.732	-	1.351	-
Thermal Conductivity (W/m°C)	0.132	-	0.166	-	-	0.125	-	0.153	-
Surface Tension (dyne/cm)	26.6	-	35.3	-	-	24.5	-	32.3	-
Aqueous Phase									
Mass Flow (kg/h)	7408.8	-	1944.6	-	-	4511.5	-	696.9	-
Composition (wt %)									
Water	96.12	2.49	2.49	0.84	0.96	93.96	1.02	1.02	0.54
Hydrogen	0.00	3.89	3.89	3.57	3.95	0.00	3.57	3.57	3.59
Methane	0.00	5.11	5.11	9.32	5.19	0.00	9.30	9.30	9.34
CO	0.00	0.11	0.11	0.11	0.11	0.00	0.11	0.11	0.11
CO2	0.00	0.04	0.04	0.03	0.04	0.00	0.03	0.03	0.03
H2S	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Acetylene	0.00	0.37	0.37	0.36	0.37	0.00	0.36	0.36	0.36
Ethylene	0.03	50.43	50.43	50.64	51.23	0.12	50.55	50.55	50.80
Ethane	0.04	32.92	32.92	30.99	33.44	0.15	30.93	30.93	31.09
MAPD	0.00	0.02	0.02	0.02	0.02	0.00	0.02	0.02	0.02
Propylene	0.01	1.12	1.12	1.01	1.14	0.03	1.00	1.00	1.01
Propane	0.00	0.24	0.24	0.22	0.25	0.01	0.22	0.22	0.22
C4's	0.12	1.79	1.79	1.59	1.82	0.20	1.59	1.59	1.60
C5+	3.68	1.46	1.46	1.29	1.47	5.53	1.29	1.29	1.29
Composition (mol %)									
Water	99.23	2.57	2.57	0.88	0.99	98.67	1.07	1.07	0.56
Hydrogen	0.00	35.83	35.83	33.27	36.41	0.00	33.20	33.20	33.37
Methane	0.00	5.92	5.92	10.90	6.02	0.00	10.87	10.87	10.93
CO	0.00	0.07	0.07	0.07	0.07	0.00	0.07	0.07	0.08
CO2	0.00	0.02	0.02	0.01	0.02	0.00	0.01	0.01	0.01
H2S	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Acetylene	0.00	0.26	0.26	0.26	0.27	0.00	0.26	0.26	0.26
Ethylene	0.02	33.41	33.41	33.87	33.95	0.08	33.80	33.80	33.98
Ethane	0.03	20.35	20.35	19.34	20.68	0.09	19.30	19.30	19.40
MAPD	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01
Propylene	0.01	0.50	0.50	0.45	0.50	0.01	0.45	0.45	0.45
Propane	0.00	0.10	0.10	0.09	0.10	0.00	0.09	0.09	0.09
C4's	0.04	0.60	0.60	0.54	0.61	0.07	0.54	0.54	0.55
C5+	0.68	0.35	0.35	0.31	0.35	1.07	0.31	0.31	0.31
Document revisions									
Updated	09/07/2004	D. Martinez Padrino			J-F. Fournier		Yvon Simon		1
Issue for design	09 / 04 / 2004	D. Martinez Padrino			C. Bagland		J-F. Fournier		0
Status	Date	Written by			Checked by		Approved by		Rev.

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SECTION 30 NORMAL CASE 100% capacity									Page
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Stream	322	325	328	331	332	333	334	341	400
Description	Liquid from D 305	CG from D 306	CG to E 306	CG from E 306	CG from E 307	CG from D 307	Liquid from D 307	Light oil to P 301	Dry CG to Section 40
Phase	Liquid	Vapor	Vapor	Mixed	Mixed	Vapor	Liquid	Liquid	Vapor
Vapour Fraction (wt%)	0.0	100.0	100.0	98.9	98.5	100.0	0.0	0.0	100.0
Temperature (°C)	25.5	49.9	95.0	45.0	15.0	15.0	15.0	42.7	14.7
Pressure (bar g)	17.52	17.09	33.26	32.80	32.63	32.56	32.56	0.20	31.80
Mass Flow (kg/h)	2864	141228	142193	142193	142193	140022	2172	399	139940
Molar Flow (kgmole/h)	146.5	7528.5	7582.1	7582.1	7582.1	7473.9	108.2	3.5	7469.4
Molecular Weight	19.55	18.76	18.75	18.75	18.75	18.73	20.07	114.59	18.74
Mass Density (kg/m3)	985.96	13.14	21.94	26.13	29.71	29.21	983.16	920.00	28.52
Actual Volume Flow (m3/h)	3	10752	6482	5442	4786	4794	2	0.4	4907
Enthalpy (kW)	-11272	-14010	-13792	-19578	-22678	-14445	-8233	-27	-14138
Vapour Phase									
Molar Flow (kgmole/h)	-	7528.5	7582.1	7498.1	7473.9	7473.9	-	-	7469.4
Mass Flow (kg/h)	-	141228	142193	140674	140022	140022	-	-	139940
Actual Volume Flow (m3/h)	-	10752	6482	5441	4784	4794	-	-	4907
Normal Volume Flow (Nm3/h)	-	168744	169945	168062	167520	167520	-	-	167419
Molecular Weight	-	18.76	18.75	18.76	18.73	18.73	-	-	18.74
Mass Density (kg/m3)	-	13.14	21.94	25.86	29.27	29.21	-	-	28.52
Viscosity (cP)	-	0.013	0.014	0.013	0.012	0.012	-	-	0.012
Specific heat (kJ/kg°C)	-	2.303	2.480	2.388	2.369	2.369	-	-	2.362
Thermal Conductivity (W/m°C)	-	0.055	0.064	0.056	0.051	0.051	-	-	0.051
Cp/Cv	-	1.30	1.30	1.36	1.41	1.41	-	-	1.41
Compressibility factor (Z)	-	0.962	0.957	0.927	0.898	0.899	-	-	0.900
HC Liquid Phase									
Molar Flow (kgmole/h)	3.87	-	-	0.06	4.17	-	4.18	3.48	-
Mass Flow (kg/h)	293.9	-	-	6.3	297.4	-	297.6	399.0	-
Actual Volume Flow (m3/h)	0.4	-	-	0.0	0.4	-	0.4	0.4	-
Molecular Weight	75.95	-	-	110.52	71.26	-	71.28	114.59	-
Mass Density (kg/m3)	830.9	-	-	975.5	817.6	-	817.8	920.0	-
Viscosity (cP)	0.433	-	-	0.836	0.410	-	0.410	0.932	-
Specific heat (kJ/kg°C)	1.789	-	-	1.525	1.793	-	1.793	1.476	-
Thermal Conductivity (W/m°C)	0.117	-	-	0.137	0.115	-	0.115	0.144	-
Surface Tension (dyne/cm)	21.4	-	-	27.9	20.5	-	20.5	29.7	-
Aqueous Phase									
Mass Flow (kg/h)	2569.9	-	-	1512.5	1873.9	-	1873.9	-	-
Composition (wt %)									
Water	89.74	0.70	1.38	1.38	1.38	0.06	86.29	0.01	0.00
Hydrogen	0.00	3.58	3.56	3.56	3.56	3.61	0.00	0.00	3.61
Methane	0.01	9.33	9.27	9.27	9.27	9.41	0.04	0.00	9.42
CO	0.00	0.11	0.11	0.11	0.11	0.11	0.00	0.00	0.11
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.01	0.36	0.35	0.35	0.35	0.36	0.01	0.00	0.36
Ethylene	0.50	50.74	50.39	50.39	50.39	51.16	0.88	0.07	51.19
Ethane	0.48	31.05	30.84	30.84	30.84	31.30	0.79	0.16	31.32
MAPD	0.00	0.02	0.02	0.02	0.02	0.02	0.00	0.01	0.02
Propylene	0.06	1.01	1.00	1.00	1.00	1.01	0.08	0.13	1.02
Propane	0.01	0.22	0.21	0.21	0.21	0.22	0.02	0.03	0.22
C4's	0.36	1.60	1.58	1.58	1.58	1.60	0.49	1.84	1.60
C5+	8.83	1.29	1.28	1.28	1.28	1.13	11.40	97.75	1.13
Composition (mol %)									
Water	97.36	0.73	1.43	1.43	1.43	0.06	96.14	0.03	0.00
Hydrogen	0.00	33.32	33.09	33.09	33.09	33.57	0.02	0.00	33.59
Methane	0.01	10.91	10.84	10.84	10.84	10.99	0.05	0.00	11.00
CO	0.00	0.07	0.07	0.07	0.07	0.08	0.00	0.00	0.08
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.26	0.26	0.26	0.26	0.26	0.01	0.01	0.26
Ethylene	0.35	33.93	33.69	33.69	33.69	34.17	0.63	0.29	34.19
Ethane	0.31	19.37	19.23	19.23	19.23	19.50	0.52	0.63	19.52
MAPD	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.03	0.01
Propylene	0.03	0.45	0.45	0.45	0.45	0.45	0.04	0.35	0.45
Propane	0.01	0.09	0.09	0.09	0.09	0.09	0.01	0.08	0.09
C4's	0.13	0.54	0.54	0.54	0.54	0.55	0.18	3.84	0.55
C5+	1.80	0.31	0.31	0.31	0.31	0.28	2.40	94.74	0.28
Document revisions									
Updated	09/07/2004	D. Martinez Padrino			J-F. Fournier		Yvon Simon		1
Issue for design	09 / 04 / 2004	D. Martinez Padrino			C. Bagland		J-F. Fournier		0
Status	Date	Written by			Checked by		Approved by		Rev.

Project N° - Unit	Doc. type	Code	Serial N°	Rev. Index
7273F - 000	CN	00 01	30 01	1

SECTION 30 NORMAL CASE 100% capacity					Page				
					4				
Stream	429	447	490	491					
Description	Fuel gas from C 401	C1 recycle from E 407	Fuel gas from W 401	Fuel gas to D 606					
Phase	Vapor	Vapor	Vapor	Vapor					
Vapour Fraction (wt%)	100.0	100.0	100.0	100.0	-	-	-	-	-
Temperature (°C)	48.7	42.0	38.5	48.5	-	-	-	-	-
Pressure (bar g)	10.75	9.40	3.00	3.00	-	-	-	-	-
Mass Flow (kg/h)	11474	17511	201	11675	-	-	-	-	-
Molar Flow (kgmole/h)	2779.2	873.7	32.1	2811.2	-	-	-	-	-
Molecular Weight	4.13	20.04	6.26	4.15	-	-	-	-	-
Mass Density (kg/m3)	1.81	8.19	0.97	0.62	-	-	-	-	-
Actual Volume Flow (m3/h)	6347	2138	208	18817	-	-	-	-	-
Enthalpy (kW)	-7632	-6215	-186	-7818	-	-	-	-	-
Vapour Phase									
Molar Flow (kgmole/h)	2779.2	873.7	32.1	2811.2	-	-	-	-	-
Mass Flow (kg/h)	11474.5	17511	201	11675	-	-	-	-	-
Actual Volume Flow (m3/h)	6347.2	2138	208	18817	-	-	-	-	-
Normal Volume Flow (Nm3/h)	62292.6	19583	719	63011	-	-	-	-	-
Molecular Weight	4.1	20.04	6.26	4.15	-	-	-	-	-
Mass Density (kg/m3)	1.8	8.19	0.97	0.62	-	-	-	-	-
Viscosity (cP)	0.0	0.012	0.010	0.010	-	-	-	-	-
Specific heat (kJ/kg°C)	7.2	2.081	4.937	7.185	-	-	-	-	-
Thermal Conductivity (W/m°C)	0.1	0.037	0.115	0.147	-	-	-	-	-
Cp/Cv	1.4	1.29	1.37	1.39	-	-	-	-	-
Compressibility factor (Z)	1.0	0.971	1.000	1.001	-	-	-	-	-
HC Liquid Phase									
Molar Flow (kgmole/h)	-	-	-	-	-	-	-	-	-
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Actual Volume Flow (m3/h)	-	-	-	-	-	-	-	-	-
Molecular Weight	-	-	-	-	-	-	-	-	-
Mass Density (kg/m3)	-	-	-	-	-	-	-	-	-
Viscosity (cP)	-	-	-	-	-	-	-	-	-
Specific heat (kJ/kg°C)	-	-	-	-	-	-	-	-	-
Thermal Conductivity (W/m°C)	-	-	-	-	-	-	-	-	-
Surface Tension (dyne/cm)	-	-	-	-	-	-	-	-	-
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt %)									
Water	0.00	0.00	0.00	0.00	-	-	-	-	-
Hydrogen	41.69	0.93	22.74	41.36	-	-	-	-	-
Methane	54.83	38.50	72.65	55.13	-	-	-	-	-
CO	1.13	0.14	1.50	1.14	-	-	-	-	-
CO2	0.00	0.00	0.00	0.00	-	-	-	-	-
H2S	0.00	0.00	0.00	0.00	-	-	-	-	-
Acetylene	0.00	0.22	0.00	0.00	-	-	-	-	-
Ethylene	2.27	46.50	3.01	2.29	-	-	-	-	-
Ethane	0.08	13.65	0.10	0.08	-	-	-	-	-
MAPD	0.00	0.00	0.00	0.00	-	-	-	-	-
Propylene	0.00	0.04	0.00	0.00	-	-	-	-	-
Propane	0.00	0.01	0.00	0.00	-	-	-	-	-
C4's	0.00	0.00	0.00	0.00	-	-	-	-	-
C5+	0.00	0.00	0.00	0.00	-	-	-	-	-
Composition (mol %)									
Water	0.00	0.00	0.00	0.00	-	-	-	-	-
Hydrogen	85.38	9.29	70.62	85.21	-	-	-	-	-
Methane	14.11	48.10	28.35	14.27	-	-	-	-	-
CO	0.17	0.10	0.34	0.17	-	-	-	-	-
CO2	0.00	0.00	0.00	0.00	-	-	-	-	-
H2S	0.00	0.00	0.00	0.00	-	-	-	-	-
Acetylene	0.00	0.17	0.00	0.00	-	-	-	-	-
Ethylene	0.33	33.22	0.67	0.34	-	-	-	-	-
Ethane	0.01	9.10	0.02	0.01	-	-	-	-	-
MAPD	0.00	0.00	0.00	0.00	-	-	-	-	-
Propylene	0.00	0.02	0.00	0.00	-	-	-	-	-
Propane	0.00	0.00	0.00	0.00	-	-	-	-	-
C4's	0.00	0.00	0.00	0.00	-	-	-	-	-
C5+	0.00	0.00	0.00	0.00	-	-	-	-	-
Document revisions									
Updated	09/07/2004	D. Martinez Padrino	J-F. Fournier	Yvon Simon	1				
Issue for design	09 / 04 / 2004	D. Martinez Padrino	C. Bagland	J-F. Fournier	0				
Status	Date	Written by	Checked by	Approved by	Rev.				

Project N° - Unit	Doc. type	Code	Swiss N°	Rev. index
7273F - 000	CN	00 01	40 01	1

SECTION 40 - COLD BOX									
NORMAL CASE									
100% capacity									
Page									
1									
Stream	400	402a	403	404	410	411	412	416	417
Description	CG from D308	CG to E401	CG from E401	CG from D401	CG from E403	CG to D402	CG from D402	CG from E404	CG to D403
Phase	Vapor	Mixed	Mixed	Vapor	Mixed	Mixed	Vapor	Mixed	Mixed
Vapour Fraction (wt%)	100.0	88.4	71.2	100.0	32.8	32.8	100.0	55.5	55.5
Temperature (°C)	14.7	-27.7	-35.5	-35.5	-69.0	-69.0	-69.0	-95.0	-95.0
Pressure (bar g)	31.80	31.20	30.90	30.85	30.45	30.45	30.40	30.15	30.15
Mass Flow (kg/h)	139941	139941	139941	99655	88555	99655	32747	18047	32747
Molar Flow (kgmole/h)	7469.4	7469.4	7469.4	6110.8	5430.1	6110.8	3665.8	2020.2	3665.8
Molecular Weight	18.74	18.74	18.74	16.31	16.31	16.31	8.93	8.93	8.93
Mass Density (kg/m3)	28.51	36.91	41.54	30.30	49.58	49.58	17.43	22.34	22.34
Actual Volume Flow (m3/h)	4908	3792	3369	3289	1786	2010	1879	808	1466
Enthalpy (kW)	-14134	-19524	-22503	-14559	-21190	-23846	-11361	-7672	-13920
Vapour Phase									
Molar Flow (kgmole/h)	7469.4	6957.8	6109.9	6110.8	3256.8	3665.1	3665.8	1716.2	3114.2
Mass Flow (kg/h)	139941	123692	99633	99655	29086	32732	32747	10018	18178
Actual Volume Flow (m3/h)	4908	3759	3284	3289	1667	1875	1879	792	1438
Normal Volume Flow (Nm3/h)	167419	155953	136947	136967	72999	82149	82165	38468	69802
Molecular Weight	18.74	17.78	16.31	16.31	8.93	8.93	8.93	5.84	5.84
Mass Density (kg/m3)	28.51	32.91	30.34	30.30	17.45	17.45	17.43	12.64	12.64
Viscosity (cP)	0.012	0.011	0.010	0.010	0.008	0.008	0.008	0.007	0.007
Specific heat (kJ/kg°C)	2.362	2.462	2.541	2.541	3.635	3.635	3.634	5.095	5.095
Thermal Conductivity (W/m°C)	0.051	0.047	0.050	0.050	0.072	0.072	0.072	0.081	0.081
Cp/Cv	1.41	1.53	1.52	1.52	1.49	1.49	1.49	1.50	1.50
Compressibility factor (Z)	0.901	0.852	0.868	0.868	0.948	0.948	0.948	0.971	0.971
HC Liquid Phase									
Molar Flow (kgmole/h)	-	511.56	1359.51	-	2173.29	2445.70	-	303.99	551.61
Mass Flow (kg/h)	-	16248.4	40307.5	-	59469.2	66923.3	-	8028.9	14568.8
Actual Volume Flow (m3/h)	-	33.1	85.3	-	119.7	134.7	-	15.3	27.8
Molecular Weight	-	31.76	29.65	-	27.36	27.36	-	26.41	26.41
Mass Density (kg/m3)	-	490.3	472.7	-	496.7	496.7	-	523.2	523.2
Viscosity (cP)	-	0.090	0.083	-	0.100	0.100	-	0.127	0.127
Specific heat (kJ/kg°C)	-	2.618	2.726	-	2.656	2.656	-	2.618	2.618
Thermal Conductivity (W/m°C)	-	0.108	0.112	-	0.136	0.136	-	0.157	0.157
Surface Tension (dyne/cm)	-	7.1	6.9	-	10.1	10.1	-	12.9	12.9
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt %)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	3.61	3.61	3.61	5.03	5.03	5.03	15.03	15.03	15.03
Methane	9.42	9.42	9.42	12.30	12.30	12.30	27.81	27.81	27.81
CO	0.11	0.11	0.11	0.15	0.15	0.15	0.43	0.43	0.43
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.36	0.36	0.36	0.35	0.35	0.35	0.21	0.21	0.21
Ethylene	51.19	51.19	51.19	53.19	53.19	53.19	42.62	42.62	42.62
Ethane	31.32	31.32	31.32	28.16	28.16	28.16	13.84	13.84	13.84
MAPD	0.02	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00
Propylene	1.02	1.02	1.02	0.47	0.47	0.47	0.05	0.05	0.05
Propane	0.22	0.22	0.22	0.09	0.09	0.09	0.01	0.01	0.01
C4's	1.60	1.60	1.60	0.24	0.24	0.24	0.00	0.00	0.00
C5+	1.13	1.13	1.13	0.02	0.02	0.02	0.00	0.00	0.00
Composition (mol %)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	33.59	33.59	33.59	40.71	40.71	40.71	66.61	66.61	66.61
Methane	11.00	11.00	11.00	12.51	12.51	12.51	15.49	15.49	15.49
CO	0.08	0.08	0.08	0.09	0.09	0.09	0.14	0.14	0.14
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.26	0.26	0.26	0.22	0.22	0.22	0.07	0.07	0.07
Ethylene	34.19	34.19	34.19	30.92	30.92	30.92	13.57	13.57	13.57
Ethane	19.52	19.52	19.52	15.27	15.27	15.27	4.11	4.11	4.11
MAPD	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.45	0.45	0.45	0.18	0.18	0.18	0.01	0.01	0.01
Propane	0.09	0.09	0.09	0.03	0.03	0.03	0.00	0.00	0.00
C4's	0.55	0.55	0.55	0.07	0.07	0.07	0.00	0.00	0.00
C5+	0.28	0.28	0.28	0.00	0.00	0.00	0.00	0.00	0.00
Document revisions									
Updated	09 / 07 / 04	D. Martinez Padrino		J.F. Fournier		Yvon Simon		1	
Issue for design	09 / 04 / 2004	D. Martinez Padrino		J.F. Fournier		Yvon Simon		0	
Status	Date	Written by		Checked by		Approved by		Rev.	

SECTION 40 - COLD BOX NORMAL CASE 100% capacity									Page 2
Stream	418	419	420	421	422	425	426	427	428
Description	CG from D403	CG to D404	CG from D404	CG to D405	D405 ovhd	H2 to W401	Fuel Gas to exp. C401	Fuel Gas from exp.	Fuel Gas to comp. C401
Phase	Vapor	Mixed	Vapor	Mixed	Vapor	Vapor	Vapor	Mixed	Vapor
Phase									
Vapour Fraction (wt%)	100.0	76.2	100.0	84.7	100.0	100.0	100.0	98.7	100.0
Temperature (°C)	-95.0	-115.0	-115.0	-135.0	-135.0	42.0	-104.2	-150.3	11.0
Pressure (bar g)	30.10	29.95	29.90	29.80	29.75	29.60	29.65	7.70	7.45
Mass Flow (kg/h)	18182	18182	13861	13861	11740	266	11474	11474	11474
Molar Flow (kgmole/h)	3114.4	3114.4	2942.0	2942.0	2843.6	64.4	2779.2	2779.2	2779.2
Molecular Weight	5.84	5.84	4.71	4.71	4.13	4.13	4.13	4.13	4.13
Mass Density (kg/m3)	12.63	14.84	11.37	13.46	11.43	4.78	9.12	3.58	1.47
Actual Volume Flow (m3/h)	1440	1225	1219	1030	1027	56	1258	3202	7785
Enthalpy (kW)	-11856	-12899	-12255	-12989	-12010	-180	-11064	-12001	-8492
Vapour Phase									
Molar Flow (kgmole/h)	3114.4	2941.9	2942.0	2843.5	2843.6	64.4	2779.2	2773.0	2779.2
Mass Flow (kg/h)	18182	13859	13861	11739	11740	266	11474	11330	11474
Actual Volume Flow (m3/h)	1440	1217	1219	1025	1027	56	1258	3202	7785
Normal Volume Flow (Nm3/h)	69806	65940	65941	63735	63736	1444	62293	62154	62293
Molecular Weight	5.84	4.71	4.71	4.13	4.13	4.13	4.13	4.09	4.13
Mass Density (kg/m3)	12.63	11.39	11.37	11.45	11.43	4.78	9.12	3.54	1.47
Viscosity (cP)	0.007	0.006	0.006	0.005	0.005	0.009	0.006	0.005	0.009
Specific heat (kJ/kg°C)	5.093	6.127	6.126	6.910	6.909	7.261	6.862	6.552	7.103
Thermal Conductivity (W/m°C)	0.081	0.081	0.081	0.077	0.077	0.147	0.089	0.067	0.134
Cp/Cv	1.50	1.52	1.52	1.55	1.55	1.40	1.50	1.51	1.40
Compressibility factor (Z)	0.971	0.974	0.974	0.967	0.967	1.009	0.988	0.984	1.002
HC Liquid Phase									
Molar Flow (kgmole/h)	-	172.50	-	98.45	-	-	-	6.19	-
Mass Flow (kg/h)	-	4322.9	-	2121.4	-	-	-	145.0	-
Actual Volume Flow (m3/h)	-	8.1	-	4.2	-	-	-	0.3	-
Molecular Weight	-	25.06	-	21.55	-	-	-	23.42	-
Mass Density (kg/m3)	-	532.0	-	500.5	-	-	-	554.1	-
Viscosity (cP)	-	0.148	-	0.141	-	-	-	0.232	-
Specific heat (kJ/kg°C)	-	2.665	-	2.933	-	-	-	2.759	-
Thermal Conductivity (W/m°C)	-	0.174	-	0.183	-	-	-	0.215	-
Surface Tension (dyne/cm)	-	14.6	-	14.0	-	-	-	18.8	-
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt %)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	26.97	26.97	35.34	35.34	41.69	41.69	41.69	41.69	41.69
Methane	43.43	43.43	52.27	52.27	54.83	54.83	54.83	54.83	54.83
CO	0.75	0.75	0.97	0.97	1.13	1.13	1.13	1.13	1.13
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.08	0.08	0.02	0.02	0.00	0.00	0.00	0.00	0.00
Ethylene	24.33	24.33	10.44	10.44	2.27	2.27	2.27	2.27	2.27
Ethane	4.44	4.44	0.96	0.96	0.08	0.08	0.08	0.08	0.08
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol %)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	78.10	78.10	82.58	82.58	85.38	85.38	85.38	85.38	85.38
Methane	15.80	15.80	15.35	15.35	14.11	14.11	14.11	14.11	14.11
CO	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17	0.17
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	5.06	5.06	1.75	1.75	0.33	0.33	0.33	0.33	0.33
Ethane	0.86	0.86	0.15	0.15	0.01	0.01	0.01	0.01	0.01
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Updated	09 / 07 / 04		D. Martinez Padrino		J.F. Fournier		Yvon Simon		1
Issue for design	09 / 04/ 2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		0
Status	Date		Written by		Checked by		Approved by		Rev.
Document revisions									

SECTION 40 - COLD BOX

NORMAL CASE

100% capacity

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100% capacity										
Stream	429	450	452	454	456	458	460	463	466	
Description	Fuel Gas to E308	Liquid from D401	Liquid from D402	Liquid from D403	Liquid from D404	Liquid from D405	D405 bot. from E407	T401 upper feed	Off gas from D409	
Phase	Vapor	Liquid	Liquid	Liquid	Liquid	Liquid	Mixed	Mixed	Vapor	
Vapour Fraction (wt%)	100.0	0.0	0.0	0.0	0.0	0.0	42.0	4.0	100.0	
Temperature (°C)	48.7	-35.5	-69.0	-95.0	-115.0	-135.0	-71.1	-73.4	-46.7	
Pressure (bar g)	10.75	30.85	30.40	30.10	29.90	29.75	10.40	10.40	10.70	
Mass Flow (kg/h)	11474	40286	66908	14565	4321	2120	6442	87915	500	
Molar Flow (kgmole/h)	2779.2	1358.6	2445.0	551.4	172.4	98.4	270.8	3267.2	18.2	
Molecular Weight	4.13	29.65	27.37	26.41	25.06	21.55	23.79	26.91	27.47	
Mass Density (kg/m3)	1.81	473	497	523	532	501	36.58	198	20.70	
Actual Volume Flow (m3/h)	6347	85	135	28	8	4	176	443	24	
Enthalpy (kW)	-7632	-7944	-12486	-2065	-644	-980	-1095	-15646	231	
Vapour Phase							131.5	207.6	18.2	
Molar Flow (kgmole/h)	2779.2	-	-	-	-	-	2703	3512	500	
Mass Flow (kg/h)	11474	-	-	-	-	-	169	276	24	
Actual Volume Flow (m3/h)	6347	-	-	-	-	-	2947	4654	408	
Normal Volume Flow (Nm3/h)	62293	-	-	-	-	-	20.56	16.91	27.47	
Molecular Weight	4.13	-	-	-	-	-	16.04	12.72	20.70	
Mass Density (kg/m3)	1.81	-	-	-	-	-	0.008	0.008	0.008	
Viscosity (cP)	0.010	-	-	-	-	-	2.058	2.216	1.866	
Specific heat (kJ/kg°C)	7.241	-	-	-	-	-	0.020	0.032	0.017	
Thermal Conductivity (W/m°C)	0.148	-	-	-	-	-	1.45	1.43	1.44	
Cp/Cv	1.39	-	-	-	-	-	0.870	0.913	0.825	
Compressibility factor (Z)	1.003	-	-	-	-	-	-	-	-	
HC Liquid Phase							139.29	3059.53	-	
Molar Flow (kgmole/h)	-	1358.63	2444.97	551.41	172.41	98.38	3738.1	84403.3	-	
Mass Flow (kg/h)	-	40285.5	66908.3	14565.0	4321.4	2120.2	7.6	167.0	-	
Actual Volume Flow (m3/h)	-	85.2	134.7	27.8	8.1	4.2	26.84	27.59	-	
Molecular Weight	-	29.65	27.37	26.41	25.06	21.55	492.6	505.3	-	
Mass Density (kg/m3)	-	472.8	496.8	523.2	532.1	500.6	0.097	0.108	-	
Viscosity (cP)	-	0.083	0.100	0.127	0.149	0.141	2.684	2.636	-	
Specific heat (kJ/kg°C)	-	2.725	2.656	2.617	2.665	2.633	0.138	0.141	-	
Thermal Conductivity (W/m°C)	-	0.112	0.136	0.157	0.174	0.183	9.5	10.7	-	
Surface Tension (dyne/cm)	-	6.9	10.1	12.9	14.6	14.0	-	-	-	
Aqueous Phase							-	-	-	
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-	
Composition (wt %)										
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Hydrogen	41.69	0.11	0.14	0.13	0.13	0.16	0.14	0.14	0.12	

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Stream	470	472	475	478	481	482	
Description	T401 ovhd to E407	T401 ovhd from E407	T401 bottom to P401	T401 bottom to E420	Ethane to E407	Ethane from E407	
Phase	Vapor	Vapor	Liquid	Mixed	Vapor	Vapor	
Vapour Fraction (wt%)	100.0	100.0	0.0	34.2	100.0	100.0	-
Temperature (°C)	-68.0	42.0	-40.2	-10.0	-39.2	42.0	-
Pressure (bar g)	10.40	9.40	10.70	24.70	6.90	6.75	-
Mass Flow (kg/h)	17511	17511	111189	111189	41665	41665	-
Molar Flow (kgmole/h)	873.7	873.7	3770.3	3770.3	1385.6	1385.6	-
Molecular Weight	20.04	20.04	29.49	29.49	30.07	30.07	-
Mass Density (kg/m3)	15.19	8.19	479	119	14.21	9.43	-
Actual Volume Flow (m3/h)	1153	2138	232	930	2932	4421	-
Enthalpy (kW)	-7302	-6215	-13077	-7251	-33858	-32114	-
Vapour Phase							
Molar Flow (kgmole/h)	873.7	873.7	-	1318.1	1385.6	1385.6	-
Mass Flow (kg/h)	17511	17511	-	37987	41665	41665	-
Actual Volume Flow (m3/h)	1153	2138	-	757	2932	4421	-
Normal Volume Flow (Nm3/h)	19583	19583	-	29544	31058	31058	-
Molecular Weight	20.04	20.04	-	28.82	30.07	30.07	-
Mass Density (kg/m3)	15.19	8.19	-	50.15	14.21	9.43	-
Viscosity (cP)	0.008	0.012	-	0.010	0.008	0.010	-
Specific heat (kJ/kg°C)	2.061	2.081	-	2.837	1.869	1.918	-
Thermal Conductivity (W/m°C)	0.023	0.037	-	0.022	0.016	0.024	-
Cp/Cv	1.44	1.29	-	1.68	1.32	1.22	-
Compressibility factor (Z)	0.882	0.971	-	0.675	0.859	0.944	-
HC Liquid Phase							
Molar Flow (kgmole/h)	-	-	3770.29	2452.17	-	-	-
Mass Flow (kg/h)	-	-	111189.4	73202.7	-	-	-
Actual Volume Flow (m3/h)	-	-	232.0	173.1	-	-	-
Molecular Weight	-	-	29.49	29.85	-	-	-
Mass Density (kg/m3)	-	-	479.2	422.9	-	-	-
Viscosity (cP)	-	-	0.086	0.062	-	-	-
Specific heat (kJ/kg°C)	-	-	2.731	3.212	-	-	-
Thermal Conductivity (W/m°C)	-	-	0.120	0.094	-	-	-
Surface Tension (dyne/cm)	-	-	7.2	3.4	-	-	-
Aqueous Phase							
Mass Flow (kg/h)	-	-	-	-	-	-	-
Composition (wt %)							
Water	0.00	0.00	0.00	0.00	0.00	0.00	-
Hydrogen	0.93	0.93	0.00	0.00	0.00	0.00	-
Methane	38.50	38.50	0.00	0.00	0.00	0.00	-
CO	0.14	0.14	0.00	0.00	0.00	0.00	-
CO2	0.00	0.00	0.00	0.00	0.00	0.00	-
H2S	0.00	0.00	0.00	0.00	0.00	0.00	-
Acetylene	0.22	0.22	0.42	0.42	0.00	0.00	-
Ethylene	46.50	46.50	57.31	57.31	0.50	0.50	-
Ethane	13.65	13.65	37.26	37.26	99.38	99.38	-
MAPD	0.00	0.00	0.03	0.03	0.00	0.00	-
Propylene	0.04	0.04	1.27	1.27	0.11	0.11	-
Propane	0.01	0.01	0.27	0.27	0.01	0.01	-
C4's	0.00	0.00	2.02	2.02	0.00	0.00	-
C5+	0.00	0.00	1.42	1.42	0.00	0.00	-
Composition (mol %)							
Water	0.00	0.00	0.00	0.00	0.00	0.00	-
Hydrogen	9.29	9.29	0.00	0.00	0.00	0.00	-
Methane	48.10	48.10	0.01	0.01	0.00	0.00	-
CO	0.10	0.10	0.00	0.00	0.00	0.00	-
CO2	0.00	0.00	0.00	0.00	0.00	0.00	-
H2S	0.00	0.00	0.00	0.00	0.00	0.00	-
Acetylene	0.17	0.17	0.47	0.47	0.00	0.00	-
Ethylene	33.22	33.22	60.24	60.24	0.54	0.54	-
Ethane	9.10	9.10	36.55	36.55	99.38	99.38	-
MAPD	0.00	0.00	0.02	0.02	0.00	0.00	-
Propylene	0.02	0.02	0.89	0.89	0.08	0.08	-
Propane	0.00	0.00	0.18	0.18	0.00	0.00	-
C4's	0.00	0.00	1.08	1.08	0.00	0.00	-
C5+	0.00	0.00	0.55	0.55	0.00	0.00	-
Document revisions							
Updated	09 / 07 / 04	D. Martinez Padrino		J.F. Fournier		Yvon Simon	1
Issue for design	09 / 04 / 2004	D. Martinez Padrino		J.F. Fournier		Yvon Simon	0
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Stream	430	431	432	451a	453	454	456	457	462
Description	Fresh ethane	Ethane from E 412	Ethane COS and As free	T402 feed	T402 bottom to E430	C3+ from E430	Ethane from E429	T402 overhead	C2 cut from E423
Phase	Vapor	Vapor	Vapor	Mixed	Liquid	Liquid	Vapor	Vapor	Vapor
Temperature (°C)	100.0	100.0	100.0	37.1	0.0	0.0	100.0	100.0	100.0
Pressure (bar g)	11.0	200.0	61.6	-10.5	82.4	45.0	-39.2	-10.8	18.7
Mass Flow (kg/h)	29.00	28.60	6.51	24.30	24.2	23.8	6.9	23.9	23.6
Molar Flow (kgmole/h)	81115	81603	81603	111189	5945	5945	41665	114714	114714
Molecular Weight	2710.7	2737.8	2737.8	3770.3	116	116	1386	3981	3981
Mass Density (kg/m3)	29.92	29.81	29.81	29.49	51.29	51.29	30.07	28.82	28.82
Actual Volume Flow (m3/h)	60.04	23.67	8.42	111	517.3	581.4	14.2	48.7	37.04
Enthalpy (kW)	1351	3447	9692	1004	11	10	2932	2358	3097
Vapour Phase	-66542	-57891	-64480	-7005	631	477	-33858	-3228	-955
Molar Flow (kgmole/h)									
Mass Flow (kg/h)	2710.7	2737.8	2737.8	1432.7	-	-	1385.6	3981.0	3981.0
Actual Volume Flow (m3/h)	81115	81603	81603	41296	-	-	41665	114714	114714
Normal Volume Flow (Nm3/h)	1351	3447	9692	840	-	-	2932	2358	3097
Molecular Weight	60758	61366	61366	32113	-	-	31058	89229	89229
Mass Density (kg/m3)	29.92	29.81	29.81	28.82	-	-	30.07	28.82	28.82
Viscosity (cP)	60.04	23.67	8.42	49.17	-	-	14.21	48.65	37.04
Specific heat (kJ/kg°C)	0.011	0.016	0.011	0.010	-	-	0.008	0.010	0.011
Thermal Conductivity (W/m°C)	3.327	2.576	1.979	2.796	-	-	1.869	2.821	2.140
Cp/Cv	0.025	0.046	0.026	0.022	-	-	0.016	0.022	0.024
Compressibility factor (Z)	1.77	1.17	1.20	1.67	-	-	1.32	1.66	1.45
HC Liquid Phase	0.633	0.947	0.956	0.679	-	-	0.859	0.679	0.792
Molar Flow (kgmole/h)									
Mass Flow (kg/h)	-	-	-	2337.58	115.91	115.91	-	-	-
Actual Volume Flow (m3/h)	-	-	-	69893.0	5944.7	5944.7	-	-	-
Molecular Weight	-	-	-	164.5	11.5	10.2	-	-	-
Mass Density (kg/m3)	-	-	-	29.90	51.29	51.29	-	-	-
Viscosity (cP)	-	-	-	425.0	517.3	581.4	-	-	-
Specific heat (kJ/kg°C)	-	-	-	0.063	0.082	0.115	-	-	-
Thermal Conductivity (W/m°C)	-	-	-	3.187	2.653	2.362	-	-	-
Surface Tension (dyne/cm)	-	-	-	0.094	0.077	0.092	-	-	-
Aqueous Phase	-	-	-	3.5	5.8	9.4	-	-	-
Mass Flow (kg/h)									
Composition (wt %)	-	-	-	-	-	-	-	-	-
Water									
Hydrogen	0.00	0.60	0.60	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	1.52	1.51	1.51	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.42	0.01	0.01	0.00	0.40	0.40
Ethane	0.00	0.00	0.00	57.31	0.12	0.12	0.50	59.84	59.84
MAPD	95.83	95.25	95.25	37.26	7.00	7.00	99.38	39.69	39.69
Propylene	0.00	0.00	0.00	0.03	0.51	0.51	0.00	0.00	0.00
Propane	0.00	0.00	0.00	1.27	23.02	23.02	0.11	0.05	0.05
C4's	2.61	2.59	2.59	0.27	5.07	5.07	0.01	0.00	0.00
C5+	0.00	0.00	0.00	2.02	37.71	37.71	0.00	0.00	0.00
Composition (mol %)	0.00	0.00	0.00	1.42	26.56	26.56	0.00	0.00	0.00
Water									
Hydrogen	0.00	0.99	0.99	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	2.84	2.81	2.81	0.01	0.00	0.00	0.00	0.01	0.01
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.47	0.02	0.02	0.00	0.45	0.45
Ethane	0.00	0.00	0.00	60.24	0.23	0.23	0.54	61.47	61.47
MAPD	95.36	94.41	94.41	36.55	11.94	11.94	99.38	38.04	38.04
Propylene	0.00	0.00	0.00	0.02	0.65	0.65	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.89	28.06	28.06	0.08	0.04	0.04
C4's	1.77	1.75	1.75	0.18	5.90	5.90	0.00	0.00	0.00
C5+	0.00	0.00	0.00	1.08	35.20	35.20	0.00	0.00	0.00
	0.00	0.00	0.00	0.55	18.00	18.00	0.00	0.00	0.00
Updated	09 / 07/ 2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		1
Issue for design	09 / 04/ 2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		0
Status	Date		Written by		Checked by		Approved by		Rev.
Document revisions									

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Stream	466	467	473	474a	474b	474c	474d	475	482
Description	Hydrog. C2 cut to E423	Hydrog. C2 cut to E421	Hydrog. C2 cut to D406	D409 feed	Hydrog. C2 cut to T403	T403 overhead	T403 reflux	T402 reflux	Ethane from E407
Phase	Vapor	Vapor	Mixed	Mixed	Mixed	Vapor	Liquid	Liquid	Vapor
Temperature (°C)	100.0	100.0	91.8	0.1	99.8	100.0	0.0	100.0	100.0
Pressure (bar g)	43.0	8.7	-14.0	-27.9	-16.1	-25.9	-27.9	-27.9	42.0
Mass Flow (kg/h)	22.65	22.45	22.24	20.4	21.5	20.8	20.4	20.4	6.8
Molar Flow (kgmole/h)	114782	114782	114782	363068	105313	353377	362568	500	41665
Molecular Weight	3981.3	3981.3	3981.3	12970.0	3654.7	12624.5	12951.8	17.2	1386
Mass Density (kg/m3)	28.83	28.83	28.83	27.99	28.82	27.99	27.99	29.00	30.07
Actual Volume Flow (m3/h)	30.65	37.30	48.43	427	43.5	42.0	433	40	9.43
Enthalpy (kW)	3745	3077	2370	849	2423	8409	837	12	4421
Vapour Phase	-679	-2952	-5452	139967	-5452	167595	139736	231	-32114
Molar Flow (kgmole/h)									
Mass Flow (kg/h)	3981.3	3981.3	3654.7	18.2	3647.3	12624.5	-	-	1385.6
Actual Volume Flow (m3/h)	114782	114782	105313	500	105097	353377	-	-	41665
Normal Volume Flow (Nm3/h)	3745	3077	2348	12	2423	8409	-	-	4421
Molecular Weight	89237	89237	81918	408	81750	282966	-	-	31058
Mass Density (kg/m3)	28.83	28.83	28.82	27.47	28.82	27.99	-	-	30.07
Viscosity (cP)	30.65	37.30	44.86	40.02	43.38	42.02	-	-	9.43
Specific heat (kJ/kg°C)	0.011	0.010	0.010	0.010	0.010	0.010	-	-	0.010
Thermal Conductivity (W/m°C)	2.023	2.177	2.675	2.393	2.640	2.499	-	-	1.918
Cp/Cv	0.026	0.023	0.021	0.021	0.021	0.020	-	-	0.024
Compressibility factor (Z)	1.36	1.48	1.62	1.64	1.61	1.65	-	-	1.22
HC Liquid Phase	0.849	0.776	0.694	0.720	0.699	0.706	-	-	0.944
Molar Flow (kgmole/h)									
Mass Flow (kg/h)	-	-	326.57	12951.78	7.45	-	12951.77	0.00	-
Actual Volume Flow (m3/h)	-	-	9469.1	362567.9	216.2	-	362567.8	0.0	-
Molecular Weight	-	-	22.4	836.8	0.5	-	836.8	0.0	-
Mass Density (kg/m3)	-	-	29.00	27.99	29.00	-	27.99	29.00	-
Viscosity (cP)	-	-	422.7	433.3	422.4	-	433.3	442.6	-
Specific heat (kJ/kg°C)	-	-	0.063	0.062	0.063	-	0.062	0.063	-
Thermal Conductivity (W/m°C)	-	-	3.226	3.134	3.234	-	3.134	3.134	-
Surface Tension (dyne/cm)	-	-	0.097	0.108	0.099	-	0.108	0.108	-
Aqueous Phase	-	-	3.7	4.0	3.8	-	4.0	4.0	-
Mass Flow (kg/h)									
Composition (wt %)	-	-	-	-	-	-	-	-	-
Water									
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00
CO	0.00	0.00	0.00	0.19	0.00	0.20	0.19	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	59.90	59.90	59.90	99.78	60.59	99.78	99.78	52.13	0.50
MAPD	40.04	40.04	40.04	0.01	39.35	0.01	0.01	47.71	99.38
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.05	0.05	0.05	0.00	0.04	0.00	0.00	0.14	0.11
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol %)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water									
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.01	0.01	0.01	0.08	0.01	0.08	0.08	0.00	0.00
CO	0.01	0.01	0.01	0.34	0.01	0.35	0.34	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	61.55	61.55	61.55	99.57	62.24	99.55	99.57	53.88	0.54
MAPD	38.39	38.39	38.39	0.01	37.71	0.01	0.01	46.01	99.38
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.04	0.04	0.04	0.00	0.03	0.00	0.00	0.10	0.08
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Updated	09 / 07/ 2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		1
Issue for design	09 / 04/ 2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		0
Status	Date		Written by		Checked by		Approved by		Rev.
Document revisions									

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SECTION 40 - ETHYLENE PURIFICATION						Page
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100% capacity						
Stream	482a	484	488	497		
Description	Ethane to furnaces	Ethane from T403	Off gas from D409	Ethylene from T403		
Phase	Vapor	Liquid	Vapor	Liquid		
Temperature (°C)	100.0	0.0	100.0	0.0		
Pressure (bar g)	55.0	-2.2	-27.9	-25.7		
Mass Flow (kg/h)	6.51	21.80	20.40	20.8		
Molar Flow (kgmole/h)	123268	41665	500	72839		
Molecular Weight	4123.5	1385.6	18.2	2596.3		
Mass Density (kg/m3)	29.89	30.07	27.47	28.05		
Actual Volume Flow (m3/h)	8.64	407.07	40.02	429		
Enthalpy (kW)	14261	102	12	170		
Vapour Phase	-96594	-37296	231	28426		
Molar Flow (kgmole/h)						
Mass Flow (kg/h)	4123.5	-	18.2	0.0		
Actual Volume Flow (m3/h)	123268	-	500	0		
Normal Volume Flow (Nm3/h)	14261	-	12	0		
Molecular Weight	92424	-	408	0		
Mass Density (kg/m3)	29.89	-	27.47	28.05		
Viscosity (cP)	8.64	-	40.02	42.20		
Specific heat (kJ/kg°C)	0.011	-	0.010	0.010		
Thermal Conductivity (W/m°C)	1.956	-	2.393	3.194		
Cp/Cv	0.025	-	0.021	0.020		
Compressibility factor (Z)	1.21	-	1.64	1.65		
HC Liquid Phase	0.952	-	0.720	0.705		
Molar Flow (kgmole/h)						
Mass Flow (kg/h)	-	1385.65	-	2596.34		
Actual Volume Flow (m3/h)	-	41665.4	-	72838.9		
Molecular Weight	-	102.4	-	169.6		
Mass Density (kg/m3)	-	30.07	-	28.05		
Viscosity (cP)	-	407.1	-	429.4		
Specific heat (kJ/kg°C)	-	0.064	-	0.061		
Thermal Conductivity (W/m°C)	-	3.431	-	3.194		
Surface Tension (dyne/cm)	-	0.090	-	0.106		
Aqueous Phase	-	3.4	-	3.8		
Mass Flow (kg/h)						
Composition (wt %)	-	-	-	-		
Water						
Hydrogen	0.40	0.00	0.00	0.00		
Methane	0.00	0.00	0.12	0.00		
CO	1.00	0.00	0.76	0.00		
CO2	0.00	0.00	0.04	0.00		
H2S	0.03	0.00	0.00	0.00		
Acetylene	0.00	0.00	0.00	0.00		
Ethylene	0.00	0.00	0.00	0.00		
Ethane	0.17	0.50	99.07	99.95		
MAPD	96.65	99.38	0.01	0.05		
Propylene	0.00	0.00	0.00	0.00		
Propane	0.04	0.11	0.00	0.00		
C4's	1.72	0.01	0.00	0.00		
C5+	0.00	0.00	0.00	0.00		
Composition (mol %)	0.00	0.00	0.00	0.00		
Water						
Hydrogen	0.66	0.00	0.00	0.00		
Methane	0.00	0.00	1.62	0.00		
CO	1.87	0.00	1.31	0.00		
CO2	0.00	0.00	0.04	0.00		
H2S	0.02	0.00	0.00	0.00		
Acetylene	0.00	0.00	0.00	0.00		
Ethylene	0.00	0.00	0.00	0.00		
Ethane	0.18	0.54	97.02	99.95		
MAPD	96.08	99.38	0.01	0.05		
Propylene	0.00	0.00	0.00	0.00		
Propane	0.03	0.08	0.00	0.00		
C4's	1.17	0.00	0.00	0.00		
C5+	0.00	0.00	0.00	0.00		
	0.00	0.00	0.00	0.00		
Updated	09 / 07 / 2004	D. Martinez Padrino	J.F. Fournier	Yvon Simon	1	
Issue for design	09 / 04 / 2004	D. Martinez Padrino	J.F. Fournier	Yvon Simon	0	
Status	Date	Written by	Checked by	Approved by	Rev.	
Document revisions						

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SECTION 50 - PROPANE REFRIGERANT CYCLE

NORMAL CASE

100% capacity , ethylene product to storage 100% liquid

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[illegible]

Updated

09/07/2004

D. Martinez Badrino

J. E. Fournier

Yves Simon

First issue

09 / 04 / 2004

D. Martinez Padrino

J.E. Fournier

Yvon Simon

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Status

Date _____

Written by

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Approved by _____

Rev

Document revisions

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SECTION 50 - PROPANE REFRIGERANT CYCLE

NORMAL CASE

100% capacity . ethylene product exported 100% vapor

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Stream	501	502	503	504	506	508	509	510	512
Description	Propane from D501	Hot propane to E407	Hot propane from E407	Propane to E307	Propane from E307	Propane to E504	Propane from E504	D503 vapor feed	Liq. propane from D503
Phase	Liquid	Liquid	Liquid	Liquid	Vapor	Mixed	Vapor	Vapor	Liquid
Vapour Fraction (wt%)	0.0	0.0	0.0	0.0	100.0	30.8	100.0	100.0	0.0
Temperature (°C)	46.4	46.4	41.3	46.4	6.0	5.2	5.5	5.7	5.2
Pressure (bar g)	15.09	15.09	14.99	15.09	4.68	4.59	4.59	4.59	4.59
Mass Flow (kg/h)	313149	245838	245838	43914	43914	23396	23396	67310	180038
Molar Flow (kgmole/h)	7112.0	5583.3	5583.3	997.4	997.4	531.4	531.4	1528.7	4084.9
Molecular Weight	44.03	44.03	44.03	44.03	44.03	44.03	44.03	44.03	44.07
Mass Density (kg/m3)	455	455	466	455	12.26	37.22	12.08	12.07	522
Actual Volume Flow (m3/h)	688	540	528	96	3582	629	1936	5576	345
Enthalpy (kW)	-231834	-182002	-183016	-32511	-29411	-17321	-15673	-45084	-138885
Vapour Phase									
Molar Flow (kgmole/h)	-	-	-	-	997.4	164.1	531.4	1528.7	-
Mass Flow (kg/h)	-	-	-	-	43914	7208	23396	67310	-
Actual Volume Flow (m3/h)	-	-	-	-	3582	598	1936	5576	-
Normal Volume Flow (Nm3/h)	-	-	-	-	22355	3678	11910	34264	-
Molecular Weight	-	-	-	-	44.03	43.93	44.03	44.03	-
Mass Density (kg/m3)	-	-	-	-	12.26	12.06	12.08	12.07	-
Viscosity (cP)	-	-	-	-	0.008	0.008	0.008	0.008	-
Specific heat (kJ/kg°C)	-	-	-	-	1.829	1.824	1.825	1.825	-
Thermal Conductivity (W/m°C)	-	-	-	-	0.017	0.016	0.016	0.016	-
Cp/Cv	-	-	-	-	1.19	1.19	1.19	1.19	-
Compressibility factor (Z)	-	-	-	-	0.879	0.880	0.880	0.880	-
HC Liquid Phase									
Molar Flow (kgmole/h)	7112.00	5583.30	5583.30	997.35	-	367.26	-	-	4084.88
Mass Flow (kg/h)	313148.9	245838.4	245838.4	43914.4	-	16188.4	-	-	180038.3
Actual Volume Flow (m3/h)	687.7	539.8	528.0	96.4	-	31.0	-	-	345.2
Molecular Weight	44.03	44.03	44.03	44.03	-	44.08	-	-	44.07
Mass Density (kg/m3)	455.4	455.4	465.6	455.4	-	521.5	-	-	521.5
Viscosity (cP)	0.081	0.081	0.085	0.081	-	0.121	-	-	0.121
Specific heat (kJ/kg°C)	2.982	2.982	2.895	2.982	-	2.565	-	-	2.565
Thermal Conductivity (W/m°C)	0.082	0.082	0.085	0.082	-	0.106	-	-	0.106
Surface Tension (dyne/cm)	4.5	4.5	5.0	4.5	-	9.3	-	-	9.3
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.25
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	99.33	99.33	99.33	99.33	99.33	99.33	99.33	99.33	99.47
C4's	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.28
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.37
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	99.18	99.18	99.18	99.18	99.18	99.18	99.18	99.18	99.42
C4's	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.21
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Updated	09/07/2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		1
First issue	09 / 04 / 2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		0
Status	Date		Written by		Checked by		Approved by		Rev.
Document revisions									

Project N° - Unit	Doc. type	Code	Serial N°	Rev. index
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SECTION 50 - PROPANE REFRIGERANT CYCLE									Page
NORMAL CASE									2
100% capacity , ethylene product exported 100% vapor									
Stream	514	516	518	519	521	522	523	525	527
Description	Vap propane from D503	Propane to E505	Propane from E505	Propane to E421	Propane from E421	Propane to LV on D504	Prop. from LV on D504	D504 vapor feed	Liq. propane from D504
Phase	Vapor	Liquid	Vapor	Mixed	Vapor	Liquid	Mixed	Vapor	Liquid
Vapour Fraction (wt%)	100.0	0.0	100.0	0.7	100.0	0.0	3.8	100.0	0.0
Temperature (°C)	5.5	-12.3	-18.0	-19.7	-32.0	-12.3	-18.4	-18.6	-18.6
Pressure (bar g)	4.59	4.39	1.62	1.52	0.55	4.39	1.62	1.62	1.62
Mass Flow (kg/h)	133111	45389	45389	23535	23535	134650	134650	45389	305827
Molar Flow (kgmole/h)	3027.1	1029.8	1029.8	534.2	534.2	3055.1	3055.1	1029.8	6942.2
Molecular Weight	43.97	44.07	44.07	44.05	44.05	44.07	44.07	44.07	44.05
Mass Density (kg/m3)	12.07	545	5.84	336	3.57	545	121	5.84	553
Actual Volume Flow (m3/h)	11032	83	7777	70	6593	247	1114	7778	553
Enthalpy (kW)	-89216	-35568	-30733	-18548	-16048	-105516	-105516	-30733	-241023
Vapour Phase									
Molar Flow (kgmole/h)	3027.1	-	1029.8	3.6	534.2	-	116.6	1029.8	-
Mass Flow (kg/h)	133111	-	45389	156	23535	-	5118	45389	-
Actual Volume Flow (m3/h)	11032	-	7777	28	6593	-	880	7778	-
Normal Volume Flow (Nm3/h)	67850	-	23082	80	11974	-	2614	23082	-
Molecular Weight	43.97	-	44.07	43.78	44.05	-	43.89	44.07	-
Mass Density (kg/m3)	12.07	-	5.84	5.60	3.57	-	5.82	5.84	-
Viscosity (cP)	0.008	-	0.007	0.007	0.007	-	0.007	0.007	-
Specific heat (kJ/kg°C)	1.824	-	1.627	1.617	1.528	-	1.626	1.627	-
Thermal Conductivity (W/m°C)	0.016	-	0.014	0.014	0.013	-	0.014	0.014	-
Cp/Cv	1.19	-	1.17	1.17	1.17	-	1.17	1.17	-
Compressibility factor (Z)	0.880	-	0.932	0.934	0.954	-	0.932	0.932	-
HC Liquid Phase									
Molar Flow (kgmole/h)	-	1029.82	-	530.67	-	3055.06	2938.43	-	6942.22
Mass Flow (kg/h)	-	45388.5	-	23378.9	-	134649.7	129531.3	-	305827.4
Actual Volume Flow (m3/h)	-	83.2	-	42.2	-	246.9	234.3	-	553.2
Molecular Weight	-	44.07	-	44.06	-	44.07	44.08	-	44.05
Mass Density (kg/m3)	-	545.4	-	554.2	-	545.4	552.7	-	552.8
Viscosity (cP)	-	0.144	-	0.155	-	0.144	0.153	-	0.153
Specific heat (kJ/kg°C)	-	2.463	-	2.429	-	2.463	2.435	-	2.434
Thermal Conductivity (W/m°C)	-	0.116	-	0.121	-	0.116	0.120	-	0.120
Surface Tension (dyne/cm)	-	11.5	-	12.4	-	11.5	12.3	-	12.3
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	0.69	0.25	0.25	0.34	0.34	0.25	0.25	0.25	0.34
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	99.14	99.47	99.47	99.42	99.42	99.47	99.47	99.47	99.42
C4's	0.17	0.28	0.28	0.24	0.24	0.28	0.28	0.28	0.24
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	1.01	0.37	0.37	0.49	0.49	0.37	0.37	0.37	0.49
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	98.86	99.42	99.42	99.32	99.32	99.42	99.42	99.42	99.32
C4's	0.13	0.21	0.21	0.18	0.18	0.21	0.21	0.21	0.18
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Document revisions									
Updated	09/07/2004	D. Martinez Padrino			J.F. Fournier		Yvon Simon		1
First issue	09 / 04 / 2004	D. Martinez Padrino			J.F. Fournier		Yvon Simon		0
Status	Date	Written by			Checked by		Approved by		Rev.

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7273F - 000	CN	00 01	50 02	1

SECTION 50 - PROPANE REFRIGERANT CYCLE									Page
NORMAL CASE									3
100% capacity , ethylene product exported 100% vapor									
Stream	528	530	533	535	540	544	546	550	551
Description	C501 2nd stage side in	Propane to E428	Propane to E506	Propane from E506	C501 first stage in	C501 discharge	C501 disch. to E420/E427	Propane to E427	Propane to E420
Phase	Vapor	Mixed	Mixed	Vapor	Vapor	Vapor	Vapor	Vapor	Vapor
Vapour Fraction (wt%)	100.0	0.7	0.7	100.0	100.0	100.0	100.0	100.0	100.0
Temperature (°C)	-12.7	-19.7	-19.7	-32.0	-32.0	79.2	79.2	26.6	26.6
Pressure (bar g)	1.62	1.52	1.52	0.55	0.55	15.99	15.99	4.59	4.59
Mass Flow (kg/h)	84445	274868	7428	7428	305830	390276	71624	196004	8731
Molar Flow (kgmole/h)	1921.4	6239.4	168.6	168.6	6942.3	8863.6	1626.7	4455.3	198.5
Molecular Weight	43.95	44.05	44.05	44.05	44.05	44.03	44.03	43.99	43.99
Mass Density (kg/m3)	5.68	336	336	3.57	3.57	31.75	31.75	10.93	10.93
Actual Volume Flow (m3/h)	14876	818	22	2081	85682	12292	2256	17938	799
Enthalpy (kW)	-57039	-216623	-5854	-5065	-208538	-249427	-45775	-129234	-5757
Vapour Phase									
Molar Flow (kgmole/h)	1921.4	41.6	1.1	168.6	6942.3	8863.6	1626.7	4455.3	198.5
Mass Flow (kg/h)	84445	1821	49	7428	305830	390276	71624	196004	8731
Actual Volume Flow (m3/h)	14876	325	9	2081	85682	12292	2256	17938	799
Normal Volume Flow (Nm3/h)	43065	932	25	3779	155604	198670	36460	99862	4448
Molecular Weight	43.95	43.78	43.78	44.05	44.05	44.03	44.03	43.99	43.99
Mass Density (kg/m3)	5.68	5.60	5.60	3.57	3.57	31.75	31.75	10.93	10.93
Viscosity (cP)	0.007	0.007	0.007	0.007	0.007	0.011	0.011	0.008	0.008
Specific heat (kJ/kg°C)	1.640	1.617	1.617	1.528	1.528	2.272	2.272	1.854	1.854
Thermal Conductivity (W/m°C)	0.014	0.014	0.014	0.013	0.013	0.025	0.025	0.018	0.018
Cp/Cv	1.17	1.17	1.17	1.17	1.17	1.23	1.23	1.17	1.17
Compressibility factor (Z)	0.936	0.934	0.934	0.954	0.954	0.804	0.804	0.904	0.904
HC Liquid Phase									
Molar Flow (kgmole/h)	-	6197.85	167.48	-	-	-	-	-	-
Mass Flow (kg/h)	-	273046.8	7378.4	-	-	-	-	-	-
Actual Volume Flow (m3/h)	-	492.7	13.3	-	-	-	-	-	-
Molecular Weight	-	44.06	44.06	-	-	-	-	-	-
Mass Density (kg/m3)	-	554.2	554.2	-	-	-	-	-	-
Viscosity (cP)	-	0.155	0.155	-	-	-	-	-	-
Specific heat (kJ/kg°C)	-	2.429	2.429	-	-	-	-	-	-
Thermal Conductivity (W/m°C)	-	0.121	0.121	-	-	-	-	-	-
Surface Tension (dyne/cm)	-	12.4	12.4	-	-	-	-	-	-
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	0.81	0.34	0.34	0.34	0.34	0.44	0.44	0.60	0.60
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	98.99	99.42	99.42	99.42	99.42	99.33	99.33	99.21	99.21
C4's	0.19	0.24	0.24	0.24	0.24	0.23	0.23	0.19	0.19
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethane	1.19	0.49	0.49	0.49	0.49	0.64	0.64	0.88	0.88
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	98.67	99.32	99.32	99.32	99.32	99.18	99.18	98.97	98.97
C4's	0.15	0.18	0.18	0.18	0.18	0.17	0.17	0.14	0.14
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Document revisions									
Updated	09/07/2004	D. Martinez Padrino		J.F. Fournier		Yvon Simon		1	
First issue	09 / 04 / 2004	D. Martinez Padrino		J.F. Fournier		Yvon Simon		0	
Status	Date	Written by		Checked by		Approved by		Rev.	

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SECTION 50 - PROPANE REFRIGERANT CYCLE							Page
NORMAL CASE							4
100% capacity , ethylene product exported 100% vapor							
Stream	554	555					
Description	Propane from E427	Propane from E420					
Phase	Liquid	Liquid					
Vapour Fraction (wt%)	0.0	0.0	-	-	-	-	-
Temperature (°C)	3.4	3.4	-	-	-	-	-
Pressure (bar g)	4.39	4.39	-	-	-	-	-
Mass Flow (kg/h)	196004	8731	-	-	-	-	-
Molar Flow (kgmole/h)	4455.3	198.5	-	-	-	-	-
Molecular Weight	43.99	43.99	-	-	-	-	-
Mass Density (kg/m3)	524	524	-	-	-	-	-
Actual Volume Flow (m3/h)	374	17	-	-	-	-	-
Enthalpy (kW)	-151546	-6751	-	-	-	-	-
Vapour Phase							
Molar Flow (kgmole/h)	-	-	-	-	-	-	-
Mass Flow (kg/h)	-	-	-	-	-	-	-
Actual Volume Flow (m3/h)	-	-	-	-	-	-	-
Normal Volume Flow (Nm3/h)	-	-	-	-	-	-	-
Molecular Weight	-	-	-	-	-	-	-
Mass Density (kg/m3)	-	-	-	-	-	-	-
Viscosity (cP)	-	-	-	-	-	-	-
Specific heat (kJ/kg°C)	-	-	-	-	-	-	-
Thermal Conductivity (W/m°C)	-	-	-	-	-	-	-
Cp/Cv	-	-	-	-	-	-	-
Compressibility factor (Z)	-	-	-	-	-	-	-
HC Liquid Phase							
Molar Flow (kgmole/h)	4455.32	198.46	-	-	-	-	-
Mass Flow (kg/h)	196003.6	8730.9	-	-	-	-	-
Actual Volume Flow (m3/h)	374.4	16.7	-	-	-	-	-
Molecular Weight	43.99	43.99	-	-	-	-	-
Mass Density (kg/m3)	523.5	523.5	-	-	-	-	-
Viscosity (cP)	0.123	0.123	-	-	-	-	-
Specific heat (kJ/kg°C)	2.555	2.555	-	-	-	-	-
Thermal Conductivity (W/m°C)	0.107	0.107	-	-	-	-	-
Surface Tension (dyne/cm)	9.5	9.5	-	-	-	-	-
Aqueous Phase							
Mass Flow (kg/h)	-	-	-	-	-	-	-
Composition (wt%)							
Water	0.00	0.00	-	-	-	-	-
Hydrogen	0.00	0.00	-	-	-	-	-
Methane	0.00	0.00	-	-	-	-	-
CO	0.00	0.00	-	-	-	-	-
CO2	0.00	0.00	-	-	-	-	-
H2S	0.00	0.00	-	-	-	-	-
Acetylene	0.00	0.00	-	-	-	-	-
Ethylene	0.00	0.00	-	-	-	-	-
Ethane	0.60	0.60	-	-	-	-	-
MAPD	0.00	0.00	-	-	-	-	-
Propylene	0.00	0.00	-	-	-	-	-
Propane	99.21	99.21	-	-	-	-	-
C4's	0.19	0.19	-	-	-	-	-
C5+	0.00	0.00	-	-	-	-	-
Composition (mol%)							
Water	0.00	0.00	-	-	-	-	-
Hydrogen	0.00	0.00	-	-	-	-	-
Methane	0.00	0.00	-	-	-	-	-
CO	0.00	0.00	-	-	-	-	-
CO2	0.00	0.00	-	-	-	-	-
H2S	0.00	0.00	-	-	-	-	-
Acetylene	0.00	0.00	-	-	-	-	-
Ethylene	0.00	0.00	-	-	-	-	-
Ethane	0.88	0.88	-	-	-	-	-
MAPD	0.00	0.00	-	-	-	-	-
Propylene	0.00	0.00	-	-	-	-	-
Propane	98.97	98.97	-	-	-	-	-
C4's	0.14	0.14	-	-	-	-	-
C5+	0.00	0.00	-	-	-	-	-
Document revisions							
Updated	09/07/2004	D. Martinez Padrino	J.F. Fournier	Yvon Simon	1		
First issue	09 / 04 / 2004	D. Martinez Padrino	J.F. Fournier	Yvon Simon	0		
Status	Date	Written by	Checked by	Approved by	Rev.		

SECTION 50 - ETHYLENE REFRIGERANT CYCLE									Page
NORMAL CASE									
100% capacity , ethylene product to storage 100% liquid									1
Stream	497	528	528a	566	566a	567	571	574	581
Description	Ethylene from T403	ethyl. prod. to E507A	ethyl. prod. to E507B	C502 discharge	ethy. prod. to C5BL	ethylene to E505	ethylene from D506	ethylene from E506	C501 3rd stage side in
Phase	Liquid	Liquid	Liquid	Vapor	Vapor	Vapor	Liquid	Liquid	Vapor
Vapour Fraction (wt%)	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	100.0
Temperature (°C)	-25.7	-48.0	-70.0	48.9	47.0	10.5	-13.0	-29.0	-48.0
Pressure (bar g)	20.83	10.33	10.28	30.11	28.00	29.51	29.26	29.01	10.33
Mass Flow (kg/h)	72839	72839	72839	155578	0	155578	155578	155578	61153
Molar Flow (kgmole/h)	2596.3	2596.3	2596.3	5545.8	0.0	5545.8	5545.8	5545.8	2180.0
Molecular Weight	28.05	28.05	28.05	28.05	28.05	28.05	28.05	28.05	28.05
Mass Density (kg/m3)	429	477	517	39.19	36.37	49.24	394	443	20.72
Actual Volume Flow (m3/h)	170	153	141	3969	0	3160	395	351	2951
Enthalpy (kW)	28427	27110	25934	80069	0	76628	62546	60249	29179
Vapour Phase									
Molar Flow (kgmole/h)	-	-	-	5545.8	-	5545.8	-	-	2180.0
Mass Flow (kg/h)	-	-	-	155578	-	155578	-	-	61153
Actual Volume Flow (m3/h)	-	-	-	3969	-	3160	-	-	2951
Normal Volume Flow (Nm3/h)	-	-	-	124304	-	124304	-	-	48863
Molecular Weight	-	-	-	28.05	-	28.05	-	-	28.05
Mass Density (kg/m3)	-	-	-	39.19	-	49.24	-	-	20.72
Viscosity (cP)	-	-	-	0.012	-	0.011	-	-	0.008
Specific heat (kJ/kg°C)	-	-	-	2.013	-	2.288	-	-	1.873
Thermal Conductivity (W/m°C)	-	-	-	0.027	-	0.024	-	-	0.016
Cp/Cv	-	-	-	1.42	-	1.63	-	-	1.44
Compressibility factor (Z)	-	-	-	0.832	-	0.737	-	-	0.819
HC Liquid Phase									
Molar Flow (kgmole/h)	2596.34	2596.34	2596.34	-	-	-	5545.82	5545.83	-
Mass Flow (kg/h)	72839.0	72839.0	72839.0	-	-	-	155577.6	155577.9	-
Actual Volume Flow (m3/h)	169.6	152.6	140.8	-	-	-	394.5	351.1	-
Molecular Weight	28.05	28.05	28.05	-	-	-	28.05	28.05	-
Mass Density (kg/m3)	429.4	477.3	517.2	-	-	-	394.3	443.2	-
Viscosity (cP)	0.061	0.081	0.106	-	-	-	0.051	0.064	-
Specific heat (kJ/kg°C)	3.194	2.748	2.565	-	-	-	3.853	3.000	-
Thermal Conductivity (W/m°C)	0.106	0.127	0.150	-	-	-	0.094	0.109	-
Surface Tension (dyne/cm)	3.8	6.9	10.2	-	-	-	2.2	4.2	-
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.96
Ethane	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Methane	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95	99.95
Ethane	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Updated	09 / 07 /2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		1
Issue for design	09 / 04 /2004		D. Martinez Padrino		J.F. Fournier		Yvon Simon		0
Status	Date		Written by		Checked by		Approved by		Rev.
Document revisions									

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SECTION 50 - ETHYLENE REFRIGERANT CYCLE								Page
NORMAL CASE								3
100% capacity , ethylene product to storage 100% liquid								
Stream	597	599						
Description	ethyl. prod. to TK701	Ethylene from E507B						
Phase	Liquid	Vapor						
Vapour Fraction (wt%)	0.0	100.0						
Temperature (°C)	-96.0	-98.0						
Pressure (bar g)	10.18	0.42						
Mass Flow (kg/h)	72839	11752						
Molar Flow (kgmole/h)	2596.3	418.9						
Molecular Weight	28.05	28.06						
Mass Density (kg/m3)	557	2.85						
Actual Volume Flow (m3/h)	131	4118						
Enthalpy (kW)	24610	5488						
Vapour Phase								
Molar Flow (kgmole/h)		418.9						
Mass Flow (kg/h)		11752						
Actual Volume Flow (m3/h)		4118						
Normal Volume Flow (Nm3/h)		9389						
Molecular Weight		28.06						
Mass Density (kg/m3)		2.85						
Viscosity (cP)		0.006						
Specific heat (kJ/kg°C)		1.372						
Thermal Conductivity (W/m°C)		0.011						
Cp/Cv		1.32						
Compressibility factor (Z)		0.961						
HC Liquid Phase								
Molar Flow (kgmole/h)	2596.34							
Mass Flow (kg/h)	72839.0							
Actual Volume Flow (m3/h)	130.8							
Molecular Weight	28.05							
Mass Density (kg/m3)	557.0							
Viscosity (cP)	0.149							
Specific heat (kJ/kg°C)	2.485							
Thermal Conductivity (W/m°C)	0.179							
Surface Tension (dyne/cm)	14.5							
Aqueous Phase								
Mass Flow (kg/h)								
Composition (wt%)								
Water	0.00	0.00						
Hydrogen	0.00	0.00						
Methane	0.00	0.00						
CO	0.00	0.00						
CO2	0.00	0.00						
H2S	0.00	0.00						
Acetylene	0.00	0.00						
Ethylene	99.95	99.93						
Ethane	0.05	0.07						
MAPD	0.00	0.00						
Propylene	0.00	0.00						
Propane	0.00	0.00						
C4's	0.00	0.00						
C5+	0.00	0.00						
Composition (mol%)								
Water	0.00	0.00						
Hydrogen	0.00	0.00						
Methane	0.00	0.00						
CO	0.00	0.00						
CO2	0.00	0.00						
H2S	0.00	0.00						
Acetylene	0.00	0.00						
Ethylene	99.95	99.93						
Ethane	0.05	0.07						
MAPD	0.00	0.00						
Propylene	0.00	0.00						
Propane	0.00	0.00						
C4's	0.00	0.00						
C5+	0.00	0.00						
Document revisions								
Updated	09 / 07 /2004	D. Martinez Padrino	J.F. Fournier	Yvon Simon	1			
Issue for design	09 / 04 /2004	D. Martinez Padrino	J.F. Fournier	Yvon Simon	0			
Status	Date	Written by	Checked by	Approved by	Rev.			

Project N° - Unit	Doc. type	Code	Serial N°	Rev. Index
7273F - 000	CN	00 01	50 04	1

SECTION 50 - ETHYLENE REFRIGERANT CYCLE									Page
NORMAL CASE									1
100% capacity , Ethylene product exported 100% vapor									
Stream	497	528	528a	566	566a	567	571	574	581
Description	Ethylene from T403	ethyl. prod. to E507A	ethyl. prod. to E507B	C502 discharge	ethyl. prod. to OSBL	ethylene to E505	ethylene from D506	ethylene from E506	C501 3rd stage side in
Phase	Liquid	Liquid	Liquid	Vapor	Vapor	Vapor	Liquid	Liquid	Vapor
Vapour Fraction (wt%)	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	100.0
Temperature (°C)	-25.7	-48.0	-70.0	56.2	54.5	10.5	-13.0	-29.0	-48.0
Pressure (bar g)	20.83	10.32	10.27	30.09	28.00	29.49	29.24	28.99	10.32
Mass Flow (kg/h)	67045	3900	3900	126020	63131	62889	53409	53395	45511
Molar Flow (kgmole/h)	2389.8	139.0	139.0	4492.0	2250.3	2241.7	1903.7	1903.3	1622.3
Molecular Weight	28.05	28.05	28.05	28.05	28.05	28.05	28.05	28.05	28.05
Mass Density (kg/m3)	429	477	517	37.71	35.03	49.20	394	443	20.72
Actual Volume Flow (m3/h)	156	8	8	3342	1802	1278	135	120	2197
Enthalpy (kW)	26165	1451	1388	65369	32748	30974	21470	20676	21718
Vapour Phase									
Molar Flow (kgmole/h)	-	-	-	4492.0	2250.3	2241.7	-	-	1622.3
Mass Flow (kg/h)	-	-	-	126020	63131	62889	-	-	45511
Actual Volume Flow (m3/h)	-	-	-	3342	1802	1278	-	-	2197
Normal Volume Flow (Nm3/h)	-	-	-	100683	50438	50245	-	-	36362
Molecular Weight	-	-	-	28.05	28.05	28.05	-	-	28.05
Mass Density (kg/m3)	-	-	-	37.71	35.03	49.20	-	-	20.72
Viscosity (cP)	-	-	-	0.012	0.012	0.011	-	-	0.008
Specific heat (kJ/kg°C)	-	-	-	1.996	1.967	2.287	-	-	1.873
Thermal Conductivity (W/m°C)	-	-	-	0.028	0.027	0.024	-	-	0.016
Cp/Cv	-	-	-	1.40	1.39	1.62	-	-	1.44
Compressibility factor (Z)	-	-	-	0.845	0.853	0.737	-	-	0.819
HC Liquid Phase									
Molar Flow (kgmole/h)	2389.82	139.01	139.01	-	-	-	1903.75	1903.26	-
Mass Flow (kg/h)	67045.0	3900.0	3900.0	-	-	-	53408.6	53394.9	-
Actual Volume Flow (m3/h)	156.1	8.2	7.5	-	-	-	135.4	120.5	-
Molecular Weight	28.05	28.05	28.05	-	-	-	28.05	28.05	-
Mass Density (kg/m3)	429.4	477.3	517.2	-	-	-	394.4	443.2	-
Viscosity (cP)	0.061	0.081	0.106	-	-	-	0.051	0.064	-
Specific heat (kJ/kg°C)	3.194	2.748	2.565	-	-	-	3.853	3.000	-
Thermal Conductivity (W/m°C)	0.106	0.127	0.150	-	-	-	0.094	0.109	-
Surface Tension (dyne/cm)	3.8	6.9	10.2	-	-	-	2.2	4.2	-
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	99.95	99.94	99.94	99.95	99.95	99.95	99.95	99.95	99.96
Ethane	0.05	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.04
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	99.95	99.94	99.94	99.95	99.95	99.95	99.95	99.95	99.96
Ethane	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Document revisions									
Updated	09 / 07 /2004	D. Martinez Padrino		J.F. Fournier		Yvon Simon		1	
Issue for design	09 / 04 /2004	D. Martinez Padrino		J.F. Fournier		Yvon Simon		0	
Status	Date	Written by		Checked by		Approved by		Rev.	

Project N° - Unit	Doc. type	Code	Serial N°	Rev. index
7273F - 000	CN	00 01	50 04	1

SECTION 50 - ETHYLENE REFRIGERANT CYCLE									
NORMAL CASE									
100% capacity , Ethylene product exported 100% vapor									
Stream	582	582a	582b	586	591	592	592a	595	596
Description	Ethylene from E402	Ethylene to E507A	Ethylene from E507A	Ethylene to LV on E403	C501 2nd stage side in	Ethylene from E403	Ethylene to LV on E404	Ethylene to E507B	C502 1st stage in
Phase	Liquid	Liquid	Vapor	Liquid	Vapor	Liquid	Liquid	Liquid	Vapor
Vapour Fraction (wt%)	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	100.0
Temperature (°C)	-48.0	-48.0	-72.0	-48.0	-72.0	-72.0	-72.0	-72.0	-98.0
Pressure (bar g)	10.32	10.32	3.78	10.32	3.78	13147	12517	629	13146
Mass Flow (kg/h)	74929	622	622	54290	57212	468.6	446.2	22.4	468.6
Molar Flow (kgmole/h)	2670.8	22.2	22.2	1935.1	2039.3	28.06	28.06	28.06	28.06
Molecular Weight	28.05	28.05	28.05	28.05	28.05	519	519	519	2.85
Mass Density (kg/m3)	477	477	8.87	477	8.86	25	24	1	4607
Actual Volume Flow (m3/h)	157	1	70	114	6454	4654	4432	223	6136
Enthalpy (kW)	27882	232	295	20202	27084	-	-	-	-
Vapour Phase									
Molar Flow (kgmole/h)	-	-	22.2	-	2039.3	-	-	-	468.6
Mass Flow (kg/h)	-	-	622	-	57212	-	-	-	13146
Actual Volume Flow (m3/h)	-	-	70	-	6454	-	-	-	4607
Normal Volume Flow (Nm3/h)	-	-	497	-	45709	-	-	-	10503
Molecular Weight	-	-	28.05	-	28.05	-	-	-	28.06
Mass Density (kg/m3)	-	-	8.87	-	8.86	-	-	-	2.85
Viscosity (cP)	-	-	0.007	-	0.007	-	-	-	0.006
Specific heat (kJ/kg°C)	-	-	1.562	-	1.562	-	-	-	1.372
Thermal Conductivity (W/m°C)	-	-	0.013	-	0.013	-	-	-	0.011
Cp/Cv	-	-	1.35	-	1.35	-	-	-	1.32
Compressibility factor (Z)	-	-	0.904	-	0.904	-	-	-	0.961
HC Liquid Phase									
Molar Flow (kgmole/h)	2670.81	22.18	-	1935.15	-	468.59	446.16	22.43	-
Mass Flow (kg/h)	74929.0	622.3	-	54290.2	-	13146.6	12517.1	629.3	-
Actual Volume Flow (m3/h)	157.0	1.3	-	113.7	-	25.3	24.1	1.2	-
Molecular Weight	28.05	28.05	-	28.05	-	28.06	28.06	28.06	-
Mass Density (kg/m3)	477.3	477.3	-	477.3	-	519.2	519.2	519.2	-
Viscosity (cP)	0.081	0.081	-	0.081	-	0.109	0.109	0.109	-
Specific heat (kJ/kg°C)	2.748	2.748	-	2.748	-	2.564	2.564	2.564	-
Thermal Conductivity (W/m°C)	0.127	0.127	-	0.127	-	0.152	0.152	0.152	-
Surface Tension (dyne/cm)	6.9	6.9	-	6.9	-	10.6	10.6	10.6	-
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	99.94	99.94	99.94	99.94	99.95	99.91	99.91	99.91	99.91
Ethane	0.06	0.06	0.06	0.06	0.05	0.09	0.09	0.09	0.09
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Composition (mol%)									
Water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Methane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H2S	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acetylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethylene	99.94	99.94	99.94	99.94	99.95	99.92	99.92	99.92	99.92
Ethane	0.05	0.05	0.05	0.05	0.05	0.08	0.08	0.08	0.08
MAPD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Propane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4's	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5+	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Document revisions									
Updated	09 / 07 /2004	D. Martinez Padrino		J.F. Fournier		Yvon Simon		1	
Issue for design	09 / 04 /2004	D. Martinez Padrino		J.F. Fournier		Yvon Simon		0	
Status	Date	Written by		Checked by		Approved by		Rev.	

SECTION 50 - ETHYLENE REFRIGERANT CYCLE

NORMAL CASE

100% capacity, Ethylene product exported 100% vapor

Page

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Stream	597	599							
Description	ethyl. prod. to TK701	Ethylene from E507B							
Phase	Liquid	Vapor							
Vapour Fraction (wt%)	0.0	100.0	-	-	-	-	-	-	-
Temperature (°C)	-96.0	-98.0	-	-	-	-	-	-	-
Pressure (bar g)	10.17	0.42	-	-	-	-	-	-	-
Mass Flow (kg/h)	3900	629	-	-	-	-	-	-	-
Molar Flow (kgmole/h)	139.0	22.4	-	-	-	-	-	-	-
Molecular Weight	28.05	28.06	-	-	-	-	-	-	-
Mass Density (kg/m3)	557	2.85	-	-	-	-	-	-	-
Actual Volume Flow (m3/h)	7	221	-	-	-	-	-	-	-
Enthalpy (kW)	1317	294	-	-	-	-	-	-	-
Vapour Phase									
Molar Flow (kgmole/h)	-	22.4	-	-	-	-	-	-	-
Mass Flow (kg/h)	-	629	-	-	-	-	-	-	-
Actual Volume Flow (m3/h)	-	221	-	-	-	-	-	-	-
Normal Volume Flow (Nm3/h)	-	503	-	-	-	-	-	-	-
Molecular Weight	-	28.06	-	-	-	-	-	-	-
Mass Density (kg/m3)	-	2.85	-	-	-	-	-	-	-
Viscosity (cP)	-	0.006	-	-	-	-	-	-	-
Specific heat (kJ/kg°C)	-	1.372	-	-	-	-	-	-	-
Thermal Conductivity (W/m°C)	-	0.011	-	-	-	-	-	-	-
Cp/Cv	-	1.32	-	-	-	-	-	-	-
Compressibility factor (Z)	-	0.961	-	-	-	-	-	-	-
HC Liquid Phase									
Molar Flow (kgmole/h)	139.01	-	-	-	-	-	-	-	-
Mass Flow (kg/h)	3900.0	-	-	-	-	-	-	-	-
Actual Volume Flow (m3/h)	7.0	-	-	-	-	-	-	-	-
Molecular Weight	28.05	-	-	-	-	-	-	-	-
Mass Density (kg/m3)	557.0	-	-	-	-	-	-	-	-
Viscosity (cP)	0.149	-	-	-	-	-	-	-	-
Specific heat (kJ/kg°C)	2.485	-	-	-	-	-	-	-	-
Thermal Conductivity (W/m°C)	0.179	-	-	-	-	-	-	-	-
Surface Tension (dyne/cm)	14.5	-	-	-	-	-	-	-	-
Aqueous Phase									
Mass Flow (kg/h)	-	-	-	-	-	-	-	-	-
Composition (wt%)									
Water	0.00	0.00	-	-	-	-	-	-	-
Hydrogen	0.00	0.00	-	-	-	-	-	-	-
Methane	0.00	0.00	-	-	-	-	-	-	-
CO	0.00	0.00	-	-	-	-	-	-	-
CO2	0.00	0.00	-	-	-	-	-	-	-
H2S	0.00	0.00	-	-	-	-	-	-	-
Acetylene	0.00	0.00	-	-	-	-	-	-	-
Ethylene	99.94	99.91	-	-	-	-	-	-	-
Ethane	0.06	0.09	-	-	-	-	-	-	-
MAPD	0.00	0.00	-	-	-	-	-	-	-
Propylene	0.00	0.00	-	-	-	-	-	-	-
Propane	0.00	0.00	-	-	-	-	-	-	-
C4's	0.00	0.00	-	-	-	-	-	-	-
C5+	0.00	0.00	-	-	-	-	-	-	-
Composition (mol%)									
Water	0.00	0.00	-	-	-	-	-	-	-
Hydrogen	0.00	0.00	-	-	-	-	-	-	-
Methane	0.00	0.00	-	-	-	-	-	-	-
CO	0.00	0.00	-	-	-	-	-	-	-
CO2	0.00	0.00	-	-	-	-	-	-	-
H2S	0.00	0.00	-	-	-	-	-	-	-
Acetylene	0.00	0.00	-	-	-	-	-	-	-
Ethylene	99.94	99.92	-	-	-	-	-	-	-
Ethane	0.05	0.08	-	-	-	-	-	-	-
MAPD	0.00	0.00	-	-	-	-	-	-	-
Propylene	0.00	0.00	-	-	-	-	-	-	-
Propane	0.00	0.00	-	-	-	-	-	-	-
C4's	0.00	0.00	-	-	-	-	-	-	-
C5+	0.00	0.00	-	-	-	-	-	-	-
Updated	09 / 07 /2004	D. Martinez Padrino	J.F. Fournier	Yvon Simon	1				
Issue for design	09 / 04 /2004	D. Martinez Padrino	J.F. Fournier	Yvon Simon	0				
Status	Date	Written by	Checked by	Approved by	Rev.				
Document revisions									