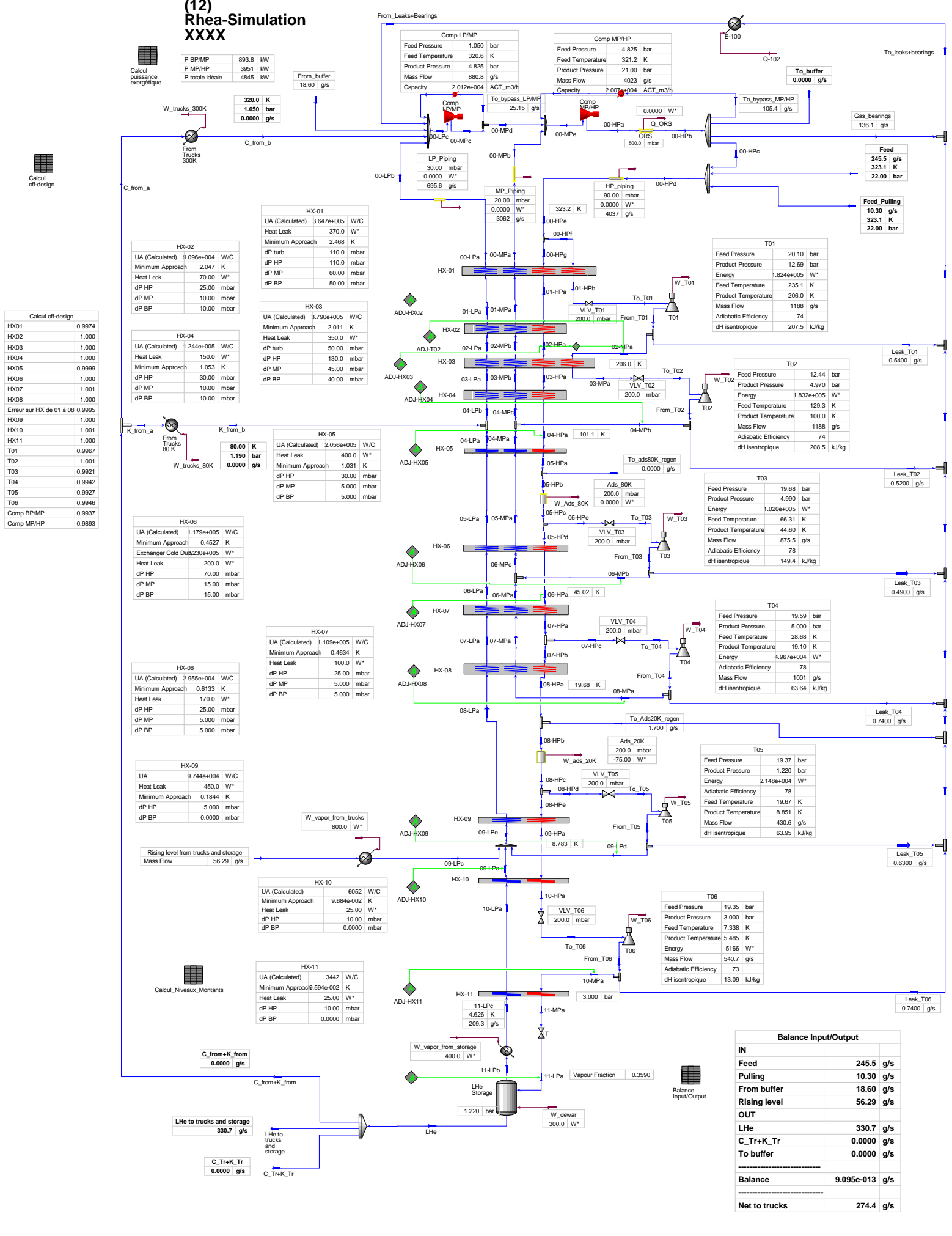


# (12) Rhea-Simulation XXXX



Calcul puissance exergétique

P BP/MP	893.8	kW
P MP/HP	3951	kW
P totale idéale	4845	kW

Calcul off-design

HX01	0.9974
HX02	1.000
HX03	1.000
HX04	1.000
HX05	0.9999
HX06	1.000
HX07	1.001
HX08	1.000
Erreur sur HX de 01 à 08	0.9995
HX09	1.000
HX10	1.001
HX11	1.000
T01	0.9967
T02	1.001
T03	0.9921
T04	0.9942
T05	0.9927
T06	0.9946
Comp BP/MP	0.9937
Comp MP/HP	0.9893

HX-01

UA (Calculated)	3.647e+005	W/C
Heat Leak	370.0	W*
Minimum Approach	2.468	K
dP turb	110.0	mbar
dP HP	110.0	mbar
dP MP	60.00	mbar
dP BP	50.00	mbar

HX-02

UA (Calculated)	9.096e+004	W/C
Heat Leak	70.00	W*
Minimum Approach	2.047	K
dP HP	25.00	mbar
dP MP	10.00	mbar
dP BP	10.00	mbar

HX-03

UA (Calculated)	3.790e+005	W/C
Heat Leak	350.0	W*
Minimum Approach	2.011	K
dP turb	50.00	mbar
dP HP	130.0	mbar
dP MP	45.00	mbar
dP BP	40.00	mbar

HX-04

UA (Calculated)	1.244e+005	W/C
Heat Leak	150.0	W*
Minimum Approach	1.053	K
dP HP	30.00	mbar
dP MP	10.00	mbar
dP BP	10.00	mbar

HX-05

UA (Calculated)	2.056e+005	W/C
Heat Leak	400.0	W*
Minimum Approach	1.031	K
dP HP	30.00	mbar
dP MP	5.000	mbar
dP BP	5.000	mbar

HX-06

UA (Calculated)	1.179e+005	W/C
Heat Leak	200.0	W*
Minimum Approach	0.4527	K
Exchanger Cold Duty	230e+005	W*
dP HP	70.00	mbar
dP MP	15.00	mbar
dP BP	15.00	mbar

HX-07

UA (Calculated)	2.955e+004	W/C
Heat Leak	170.0	W*
Minimum Approach	0.6133	K
dP HP	25.00	mbar
dP MP	5.000	mbar
dP BP	5.000	mbar

HX-08

UA (Calculated)	9.744e+004	W/C
Heat Leak	450.0	W*
Minimum Approach	0.1844	K
dP HP	25.00	mbar
dP MP	5.000	mbar
dP BP	0.0000	mbar

HX-09

UA (Calculated)	6052	W/C
Heat Leak	9.684e-002	K
Minimum Approach	9.594e-002	K
dP HP	25.00	W*
dP MP	10.00	mbar
dP BP	0.0000	mbar

HX-10


UA (Calculated)	3442	W/C
Heat Leak	25.00	W*
Minimum Approach	9.594e-002	K
dP HP	10.00	mbar
dP MP	0.0000	mbar
dP BP	0.0000	mbar

HX-11

UA (Calculated)	3442	W/C
Heat Leak	25.00	W*
Minimum Approach	9.594e-002	K
dP HP	10.00	mbar
dP MP	0.0000	mbar
dP BP	0.0000	mbar


Balance Input/Output

IN	
Feed	245.5 g/s
Pulling	10.30 g/s
From buffer	18.60 g/s
Rising level	56.29 g/s
OUT	
LHe	330.7 g/s
C_Tr+K_Tr	0.0000 g/s
To buffer	0.0000 g/s
Balance	9.095e-013 g/s
Net to trucks	274.4 g/s

1	 AIR LIQUIDE ENGINEERING Calgary, Alberta CANADA	Case Name:	D:\DOCUMENTS AND SETTINGS\CINDY.DESCHILDREMY DOCUME
2		Unit Set:	Cryogénie - K - bar - g/s1
3		Date/Time:	Tue Aug 24 10:46:43 2010
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## Workbook: Case (Main)

		Streams					Fluid Pkg:	All
11	Name	00-HPa	00-HPb	00-HPc	00-HPd	00-HPe		
12	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
13	Temperature (K)	323.1 *	323.2	323.2	323.2	323.2	323.2	
14	Pressure (bar)	21.00 *	20.50	20.50	20.50	20.41	20.41	
15	Mass Flow (g/s)	4023	4023	3782	4037	4037	4037	
16	Mass Enthalpy (J/g)	1685	1685	1685	1685	1685	1685	
17	Heat Flow (W*)	6.778e+006	6.778e+006	6.371e+006	6.802e+006	6.802e+006	6.802e+006	
18	Name	00-HPf	00-HPg	00-LPa	00-LPb	00-LPc		
19	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
20	Temperature (K)	323.2	323.2	320.7	320.7	320.6	320.6	
21	Pressure (bar)	20.41	20.41	1.080	1.050	1.050 *	1.050 *	
22	Mass Flow (g/s)	1188	2849	695.6	695.6	880.8	880.8	
23	Mass Enthalpy (J/g)	1685	1685	1666	1666	1665	1665	
24	Heat Flow (W*)	2.002e+006	4.800e+006	1.159e+006	1.159e+006	1.466e+006	1.466e+006	
25	Name	00-MPa	00-MPb	00-MPc	00-MPd	00-MPe		
26	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
27	Temperature (K)	320.7	320.7	323.1 *	323.1	321.2	321.2	
28	Pressure (bar)	4.845	4.825	4.825	4.825	4.825	4.825	
29	Mass Flow (g/s)	3062	3062	880.8	855.6	4023	4023	
30	Mass Enthalpy (J/g)	1667	1667	1680	1680	1670	1670	
31	Heat Flow (W*)	5.104e+006	5.104e+006	1.479e+006	1.437e+006	6.716e+006	6.716e+006	
32	Name	01-HPa	01-HPb	01-LPa	01-MPa	2		
33	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
34	Temperature (K)	235.1	235.1	226.1	226.1	12.21	12.21	
35	Pressure (bar)	20.30	20.30	1.130	4.905	1.220	1.220	
36	Mass Flow (g/s)	2849	1188	695.6	3062	3.070	3.070	
37	Mass Enthalpy (J/g)	1228	1228	1174	1176	61.83	61.83	
38	Heat Flow (W*)	3.498e+006	1.458e+006	8.169e+005	3.600e+006	189.8	189.8	
39	Name	02-HPa	02-LPa	02-MPa	02-MPb	03-HPa		
40	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
41	Temperature (K)	206.2 *	204.1	206.0	204.1	129.3	129.3	
42	Pressure (bar)	20.28	1.140	12.69 *	4.915	20.15	20.15	
43	Mass Flow (g/s)	2849	695.6	1188	3062	2849	2849	
44	Mass Enthalpy (J/g)	1077	1060	1074	1062	677.5	677.5	
45	Heat Flow (W*)	3.070e+006	7.376e+005	1.275e+006	3.251e+006	1.930e+006	1.930e+006	
46	Name	03-LPa	03-MPa	03-MPb	4	04-HPa		
47	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
48	Temperature (K)	121.5	129.3	121.5	5.356	101.1 *	101.1 *	
49	Pressure (bar)	1.180	12.64	4.960	1.220	20.12	20.12	
50	Mass Flow (g/s)	695.6	1188	3062	1.370	2849	2849	
51	Mass Enthalpy (J/g)	631.2	675.2	632.3	22.74	530.8	530.8	
52	Heat Flow (W*)	4.390e+005	8.018e+005	1.936e+006	31.16	1.512e+006	1.512e+006	
53	Name	04-LPa	04-LPb	04-MPa	04-MPb	04-MPc		
54	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
55	Temperature (K)	100.1	100.1	100.1	100.0 *	100.1	100.1	
56	Pressure (bar)	1.190	1.190	4.970	4.970	4.970	4.970	
57	Mass Flow (g/s)	695.6	695.6	1875	1187 *	3062	3062	
58	Mass Enthalpy (J/g)	520.1	520.1	521.2	520.9	521.0	521.0	
59	Heat Flow (W*)	3.618e+005	3.618e+005	9.772e+005	6.183e+005	1.595e+006	1.595e+006	
60	Name	5	05-HPa	05-HPb	05-HPc	05-HPd		
61	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
62	Temperature (K)	13.45	66.30	66.30	66.31	66.31	66.31	
63	Pressure (bar)	1.220	20.09	20.09	19.89	19.89	19.89	
64	Mass Flow (g/s)	3.810	2849	2849	2849	1974	1974	
65	Mass Enthalpy (J/g)	68.52	348.5	348.5	348.5	348.5	348.5	
66	Heat Flow (W*)	261.1	9.928e+005	9.928e+005	9.928e+005	6.878e+005	6.878e+005	

1	 <b>AIR LIQUIDE ENGINEERING</b> Calgary, Alberta CANADA	Case Name:	D:\DOCUMENTS AND SETTINGS\CINDY.DESCHILDREMY DOCUME
2		Unit Set:	Cryogénie - K - bar - g/s1
3		Date/Time:	Tue Aug 24 10:46:43 2010
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## Workbook: Case (Main) (continued)

Streams (continued)							Fluid Pkg:	All
11	Name	05-HPe	05-LPa	05-MPa	6	06-HPa		
12	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
13	Temperature (K)	66.31	61.21	61.21	16.96	45.02 *		
14	Pressure (bar)	19.89	1.195	4.975	1.220	19.82		
15	Mass Flow (g/s)	875.5	695.6	1875	4.300	1974		
16	Mass Enthalpy (J/g)	348.5	318.0	318.7	87.14	235.5		
17	Heat Flow (W*)	3.051e+005	2.212e+005	5.977e+005	374.7	4.648e+005		
18	Name	06-LPa	06-MPa	06-MPb	06-MPc	07-HPa		
19	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000		
20	Temperature (K)	44.56	44.56	44.60 *	44.58	28.68		
21	Pressure (bar)	1.210	4.990	4.990	4.990	19.79		
22	Mass Flow (g/s)	695.6	1000	875.0 *	1875	1974		
23	Mass Enthalpy (J/g)	231.5	231.7	231.9	231.8	145.9		
24	Heat Flow (W*)	1.610e+005	2.317e+005	2.029e+005	4.347e+005	2.881e+005		
25	Name	07-HPb	07-HPc	07-LPa	07-MPa	08-HPa		
26	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000		
27	Temperature (K)	28.68	28.68	24.73	24.73	19.68		
28	Pressure (bar)	19.79	19.79	1.215	4.995	19.77		
29	Mass Flow (g/s)	973.1	1001	695.6	1000	973.1		
30	Mass Enthalpy (J/g)	145.9	145.9	128.0	126.9	93.32		
31	Heat Flow (W*)	1.420e+005	1.461e+005	8.906e+004	1.269e+005	9.081e+004		
32	Name	08-HPb	08-HPc	08-HPd	08-HPe	08-LPa		
33	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000		
34	Temperature (K)	19.68	19.68	19.68	19.68	19.04		
35	Pressure (bar)	19.77	19.57	19.57	19.57	1.220		
36	Mass Flow (g/s)	971.4	971.4	430.6	540.7	695.6		
37	Mass Enthalpy (J/g)	93.32	93.40	93.40	93.40	98.14		
38	Heat Flow (W*)	9.065e+004	9.073e+004	4.022e+004	5.050e+004	6.826e+004		
39	Name	08-MPa	09-HPa	09-LPa	09-LPc	09-LPd		
40	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000		
41	Temperature (K)	19.10 *	8.783	8.686 *	6.420	8.851 *		
42	Pressure (bar)	5.000 *	19.56	1.220	1.220	1.220		
43	Mass Flow (g/s)	1000 *	540.7	209.3	56.29	430.0 *		
44	Mass Enthalpy (J/g)	96.31	22.16	42.60	29.52	43.52		
45	Heat Flow (W*)	9.631e+004	1.198e+004	8916	1662	1.871e+004		
46	Name	09-LPe	10-HPa	10-LPa	10-MPa	11		
47	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000		
48	Temperature (K)	8.598	7.323	5.389	5.485 *	25.86		
49	Pressure (bar)	1.220	19.55	1.220	3.000 *	1.220		
50	Mass Flow (g/s)	695.6	540.7	209.3	540.0	4.820		
51	Mass Enthalpy (J/g)	42.11	14.61	22.97	5.051	133.9		
52	Heat Flow (W*)	2.929e+004	7898	4807	2728	645.6		
53	Name	11-LPa	11-LPb	11-LPc	11-MPa	C_from+K_from		
54	Vapour Fraction	0.3590 *	1.0000	1.0000	1.0000	0.0000		
55	Temperature (K)	4.425	4.425	4.626	5.372	4.425		
56	Pressure (bar)	1.220 *	1.220	1.220	2.990	1.220		
57	Mass Flow (g/s)	540.0 *	209.3	209.3	540.0	0.0000 *		
58	Mass Enthalpy (J/g)	2.870	15.31	17.22	2.870	-4.096		
59	Heat Flow (W*)	1550	3204	3604	1550	0.0000		
60	Name	C_from_a	C_from_b	C_Tr+K_Tr	Feed	Feed_Pulling		
61	Vapour Fraction	0.0000	1.0000	0.0000	1.0000	1.0000		
62	Temperature (K)	4.425	320.0 *	4.425	323.1 *	323.1 *		
63	Pressure (bar)	1.220	1.050	1.220	22.00 *	22.00 *		
64	Mass Flow (g/s)	0.0000 *	0.0000	0.0000 *	245.5 *	10.30 *		
65	Mass Enthalpy (J/g)	-4.096	1662	-4.096	1685	1685		
66	Heat Flow (W*)	0.0000	0.0000	0.0000	4.137e+005	1.736e+004		

1	 AIR LIQUIDE ENGINEERING Calgary, Alberta CANADA	Case Name:	D:\DOCUMENTS AND SETTINGS\CINDY.DESCHILDREMY DOCUME
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3		Date/Time:	Tue Aug 24 10:46:43 2010
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## Workbook: Case (Main) (continued)

Streams (continued)						Fluid Pkg:	All
11	Name	From_buffer	From_bypass_LP/MP	From_bypass_MP/HP	From_Leaks+Bearings	From_T01	
12	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
13	Temperature (K)	320.0 *	320.0 *	320.0 *	320.0 *	206.0	206.0
14	Pressure (bar)	1.050	1.050	4.825	1.050	12.69	12.69
15	Mass Flow (g/s)	18.60 *	25.15	105.4	141.5	1188	1188
16	Mass Enthalpy (J/g)	1662	1662	1663	1662	1074	1074
17	Heat Flow (W*)	3.091e+004	4.180e+004	1.753e+005	2.351e+005	1.276e+006	1.276e+006
18	Name	From_T02	From_T03	From_T04	From_T05	From_T06	
19	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
20	Temperature (K)	100.0	44.60	19.10	8.851	5.485	5.485
21	Pressure (bar)	4.970	4.990	5.000	1.220	3.000 *	3.000 *
22	Mass Flow (g/s)	1188	875.5	1001	430.6	540.7	540.7
23	Mass Enthalpy (J/g)	520.9	231.9	96.31	43.52	5.051	5.051
24	Heat Flow (W*)	6.185e+005	2.030e+005	9.638e+004	1.874e+004	2731	2731
25	Name	Gas_bearings	K_from_a	K_from_b	Leak_T01	Leak_T02	
26	Vapour Fraction	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000
27	Temperature (K)	323.2	4.425	80.00 *	206.0	100.0	100.0
28	Pressure (bar)	20.50	1.220	1.190	12.69	4.970	4.970
29	Mass Flow (g/s)	136.1 *	0.0000	0.0000	0.5400 *	0.5200 *	0.5200 *
30	Mass Enthalpy (J/g)	1685	-4.096	415.7	1074	520.9	520.9
31	Heat Flow (W*)	2.293e+005	0.0000	0.0000	580.0	270.8	270.8
32	Name	Leak_T03	Leak_T04	Leak_T05	Leak_T06	Leaks	
33	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
34	Temperature (K)	44.60	19.10	8.851	5.485	44.02	44.02
35	Pressure (bar)	4.990	5.000	1.220	3.000	1.220	1.220
36	Mass Flow (g/s)	0.4900 *	0.7400 *	0.6300 *	0.7400 *	5.360	5.360
37	Mass Enthalpy (J/g)	231.9	96.31	43.52	5.051	228.6	228.6
38	Heat Flow (W*)	113.6	71.27	27.42	3.738	1226	1226
39	Name	LHe	LHe to trucks and stor	Q-102	Q_ORs	Q_pipeBP	
40	Vapour Fraction	0.0000	0.0000	---	---	---	---
41	Temperature (K)	4.425	4.425	---	---	---	---
42	Pressure (bar)	1.220	1.220	---	---	---	---
43	Mass Flow (g/s)	330.7	330.7	---	---	---	---
44	Mass Enthalpy (J/g)	-4.096	-4.096	---	---	---	---
45	Heat Flow (W*)	-1354	-1354	4584	0.0000 *	0.0000 *	0.0000 *
46	Name	Q_pipeHP	Q_pipeMP	Rising level from truck	To_Ads20K_regen	To_ads80K_regen	
47	Vapour Fraction	---	---	1.0000 *	1.0000	1.0000	1.0000
48	Temperature (K)	---	---	4.425	19.68	66.30	66.30
49	Pressure (bar)	---	---	1.220	19.77	20.09	20.09
50	Mass Flow (g/s)	---	---	56.29	1.700 *	0.0000 *	0.0000 *
51	Mass Enthalpy (J/g)	---	---	15.31	93.32	348.5	348.5
52	Heat Flow (W*)	0.0000 *	0.0000 *	861.9	158.6	0.0000	0.0000
53	Name	To_buffer	To_bypass_LP/MP	To_bypass_MP/HP	To_leaks+bearings	To_T01	
54	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
55	Temperature (K)	323.2	323.1	323.2	313.7	235.1	235.1
56	Pressure (bar)	20.50	4.825	20.50	1.220	20.10	20.10
57	Mass Flow (g/s)	0.0000 *	25.15 *	105.4 *	141.5	1188	1188
58	Mass Enthalpy (J/g)	1685	1680	1685	1630	1228	1228
59	Heat Flow (W*)	0.0000	4.224e+004	1.775e+005	2.305e+005	1.458e+006	1.458e+006
60	Name	To_T02	To_T03	To_T04	To_T05	To_T06	
61	Vapour Fraction	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
62	Temperature (K)	129.3	66.31	28.68	19.67	7.338	7.338
63	Pressure (bar)	12.44	19.68	19.59	19.37	19.35	19.35
64	Mass Flow (g/s)	1188	875.5	1001	430.6	540.7	540.7
65	Mass Enthalpy (J/g)	675.2	348.5	145.9	93.40	14.61	14.61
66	Heat Flow (W*)	8.018e+005	3.051e+005	1.461e+005	4.022e+004	7898	7898



AIR LIQUIDE ENGINEERING  
 Calgary, Alberta  
 CANADA

Case Name: D:\DOCUMENTS AND SETTINGS\CINDY.DESCHILDREMY DOCUME  
 Unit Set: Cryogénie - K - bar - g/s1  
 Date/Time: Tue Aug 24 10:46:43 2010

## Workbook: Case (Main) (continued)

### Streams (continued)

Fluid Pkg: All

Name	W_ads_20K	W_Ads_80K	W_dewar	W_T01	W_T02
Vapour Fraction	---	---	---	---	---
Temperature (K)	---	---	---	---	---
Pressure (bar)	---	---	---	---	---
Mass Flow (g/s)	---	---	---	---	---
Mass Enthalpy (J/g)	---	---	---	---	---
Heat Flow (W*)	-75.00 *	0.0000 *	300.0 *	1.824e+005	1.832e+005
Name	W_T03	W_T04	W_T05	W_T06	W_trucks_300K
Vapour Fraction	---	---	---	---	---
Temperature (K)	---	---	---	---	---
Pressure (bar)	---	---	---	---	---
Mass Flow (g/s)	---	---	---	---	---
Mass Enthalpy (J/g)	---	---	---	---	---
Heat Flow (W*)	1.020e+005	4.967e+004	2.148e+004	5166	0.0000
Name	W_trucks_80K	W_vapor_from_storag	W_vapor_from_trucks		
Vapour Fraction	---	---	---		
Temperature (K)	---	---	---		
Pressure (bar)	---	---	---		
Mass Flow (g/s)	---	---	---		
Mass Enthalpy (J/g)	---	---	---		
Heat Flow (W*)	0.0000	400.0 *	800.0 *		