

# Rhea-Design Ex8\_2.1.2-Sans\_LN2 Version(12)

P BP/MP	899.6	kW
P MP/HP	3995	kW
P totale idéale	4894	kW

From_buffer	0.0000	g/s
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From\_Leaks+Bearings

Comp LP/MP		
Feed Pressure	1.050	bar
Feed Temperature	320.5	K
Product Pressure	4.825	bar
Mass Flow	886.5	g/s
Capacity	2.024e+004	ACT_m3/h

Comp MP/HP		
Feed Pressure	4.825	bar
Feed Temperature	321.2	K
Product Pressure	21.00	bar
Mass Flow	4067	g/s
Capacity	2.028e+004	ACT_m3/h

E-100

To_buffer	0.0000	g/s
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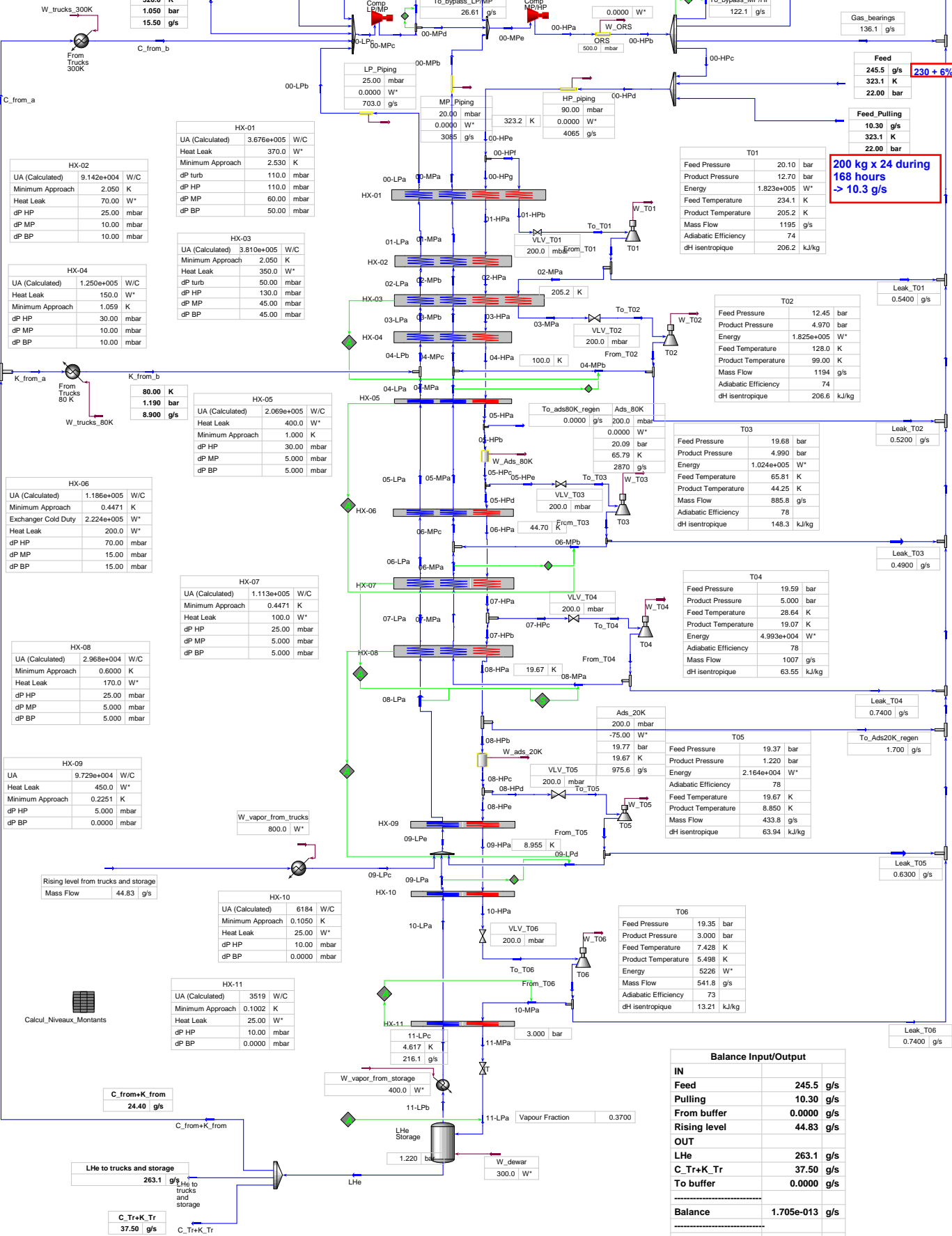
To\_Leaks+Bearings

Calcul puissance énergétique

Calcul off-design

Calcul off-design	
HX01	1.000
HX02	1.000
HX03	1.000
HX04	1.000
HX05	1.000
HX06	1.000
HX07	1.000
HX08	1.000
HX09	1.000
HX10	1.000
HX11	1.000
T01	1.000
T02	1.000
T03	1.000
T04	1.000
T05	1.000
T06	1.000
Comp BP/MP	1.000
Comp MP/HP	1.000

Balance Input/Output



HX-02		
UA (Calculated)	9.142e+004	W/C
Minimum Approach	2.050	K
Heat Leak	70.00	W*
dP HP	25.00	mbar
dP MP	10.00	mbar
dP BP	10.00	mbar

HX-01		
UA (Calculated)	3.676e+005	W/C
Heat Leak	370.0	W*
Minimum Approach	2.530	K
dP turb	110.0	mbar
dP HP	110.0	mbar
dP MP	60.00	mbar
dP BP	50.00	mbar

HX-03		
UA (Calculated)	3.810e+005	W/C
Minimum Approach	2.050	K
Heat Leak	350.0	W*
dP turb	50.00	mbar
dP HP	130.0	mbar
dP MP	45.00	mbar
dP BP	45.00	mbar

HX-04		
UA (Calculated)	1.250e+005	W/C
Minimum Approach	1.059	K
Heat Leak	150.0	W*
dP HP	30.00	mbar
dP MP	10.00	mbar
dP BP	10.00	mbar

HX-05		
UA (Calculated)	2.069e+005	W/C
Minimum Approach	1.000	K
Heat Leak	400.0	W*
dP HP	30.00	mbar
dP MP	5.000	mbar
dP BP	5.000	mbar

HX-06		
UA (Calculated)	1.186e+005	W/C
Minimum Approach	0.4471	K
Exchanger Cold Duty	2.224e+005	W*
Heat Leak	200.0	W*
dP HP	70.00	mbar
dP MP	15.00	mbar
dP BP	15.00	mbar

HX-07		
UA (Calculated)	1.113e+005	W/C
Minimum Approach	0.4471	K
Heat Leak	100.0	W*
dP HP	25.00	mbar
dP MP	5.000	mbar
dP BP	5.000	mbar

HX-08		
UA (Calculated)	2.968e+004	W/C
Minimum Approach	0.6000	K
Heat Leak	170.0	W*
dP HP	25.00	mbar
dP MP	5.000	mbar
dP BP	5.000	mbar

HX-09		
UA (Calculated)	9.729e+004	W/C
Minimum Approach	0.2251	K
Heat Leak	450.0	W*
dP HP	5.000	mbar
dP BP	0.0000	mbar

HX-10		
UA (Calculated)	6184	W/C
Minimum Approach	0.1050	K
Heat Leak	25.00	W*
dP HP	10.00	mbar
dP BP	0.0000	mbar

HX-11		
UA (Calculated)	3519	W/C
Minimum Approach	0.1002	K
Heat Leak	25.00	W*
dP HP	10.00	mbar
dP BP	0.0000	mbar

Calcul\_Niveaux\_Montants

C_from+K from	24.40	g/s
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LHe to trucks and storage	263.1	g/s
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C_Tr+K_Tr	37.50	g/s
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230 + 6%

200 kg x 24 during 168 hours -> 10.3 g/s

Balance Input/Output	
IN	
Feed	245.5 g/s
Pulling	10.30 g/s
From buffer	0.0000 g/s
Rising level	44.83 g/s
OUT	
LHe	263.1 g/s
C_Tr+K_Tr	37.50 g/s
To buffer	0.0000 g/s
Balance	1.705e-013 g/s
Net to trucks	255.8 g/s

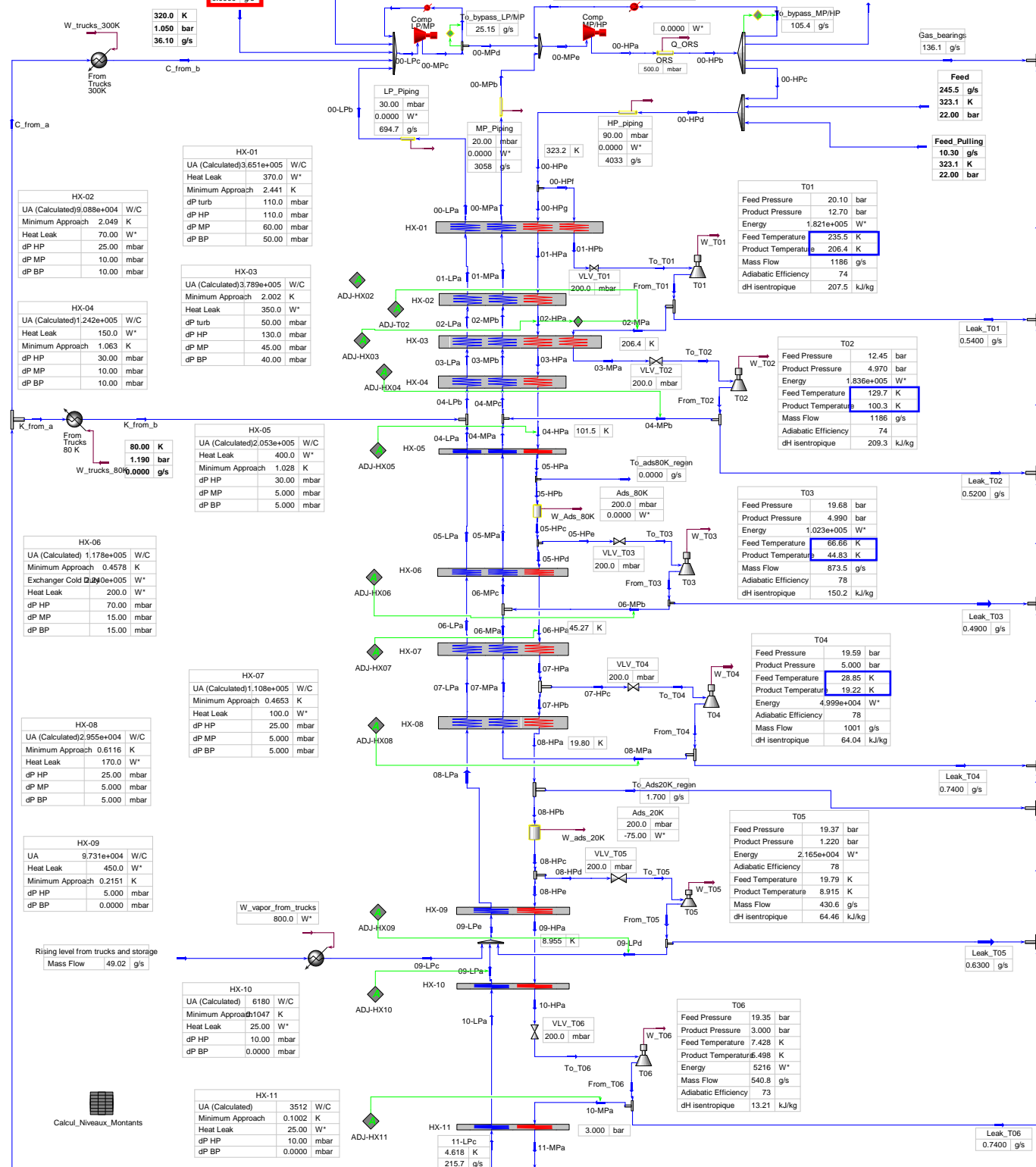
# (12) Rhea-Simulation CXXX

Calcul puissance énergétique

P BP/MP	910.6	kW
P MP/HP	3964	kW
P totale idéale	4874	kW

From\_buffer  
0.0000 g/s

To\_buffer  
16.50 g/s



Calcul off-design

HX01	0.9993
HX02	1.000
HX03	1.001
HX04	1.000
HX05	0.9995
HX06	1.000
HX07	1.000
HX08	1.000
Erreur sur HX de 01 à 08	9999
HX09	0.9995
HX10	1.001
HX11	0.9992
T01	0.9958
T02	0.9998
T03	0.9923
T04	0.9972
T05	0.9963
T06	0.9982
Comp BP/MP	1.012
Comp MP/HP	0.9925

HX-02

UA (Calculated)	9.088e+004	W/C
Heat Leak	2.049	K
Minimum Approach	70.00	W*
dP turb	25.00	mbar
dP HP	10.00	mbar
dP MP	10.00	mbar
dP BP	10.00	mbar

HX-04

UA (Calculated)	1.242e+005	W/C
Heat Leak	150.0	W*
Minimum Approach	1.063	K
dP turb	30.00	mbar
dP HP	10.00	mbar
dP MP	10.00	mbar
dP BP	10.00	mbar

HX-03

UA (Calculated)	3.789e+005	W/C
Heat Leak	350.0	W*
Minimum Approach	2.002	K
dP turb	50.00	mbar
dP HP	130.0	mbar
dP MP	45.00	mbar
dP BP	40.00	mbar

HX-05

UA (Calculated)	2.053e+005	W/C
Heat Leak	400.0	W*
Minimum Approach	1.028	K
dP turb	30.00	mbar
dP HP	5.000	mbar
dP MP	5.000	mbar
dP BP	5.000	mbar

HX-06

UA (Calculated)	1.178e+005	W/C
Heat Leak	40.00	W*
Minimum Approach	0.4578	K
Exchanger Cold Duty	0.0000	W*
Heat Leak	200.0	W*
dP HP	70.00	mbar
dP MP	15.00	mbar
dP BP	15.00	mbar

HX-07

UA (Calculated)	1.108e+005	W/C
Heat Leak	100.0	W*
Minimum Approach	0.4653	K
dP HP	25.00	mbar
dP MP	5.000	mbar
dP BP	5.000	mbar

HX-08

UA (Calculated)	2.955e+004	W/C
Heat Leak	450.0	W*
Minimum Approach	0.2151	K
dP HP	25.00	mbar
dP MP	5.000	mbar
dP BP	5.000	mbar

HX-09

UA (Calculated)	9.731e+004	W/C
Heat Leak	25.00	W*
Minimum Approach	0.2151	K
dP HP	5.000	mbar
dP MP	0.0000	mbar

HX-10

UA (Calculated)	6180	W/C
Heat Leak	25.00	W*
Minimum Approach	0.1047	K
dP HP	10.00	mbar
dP MP	0.0000	mbar

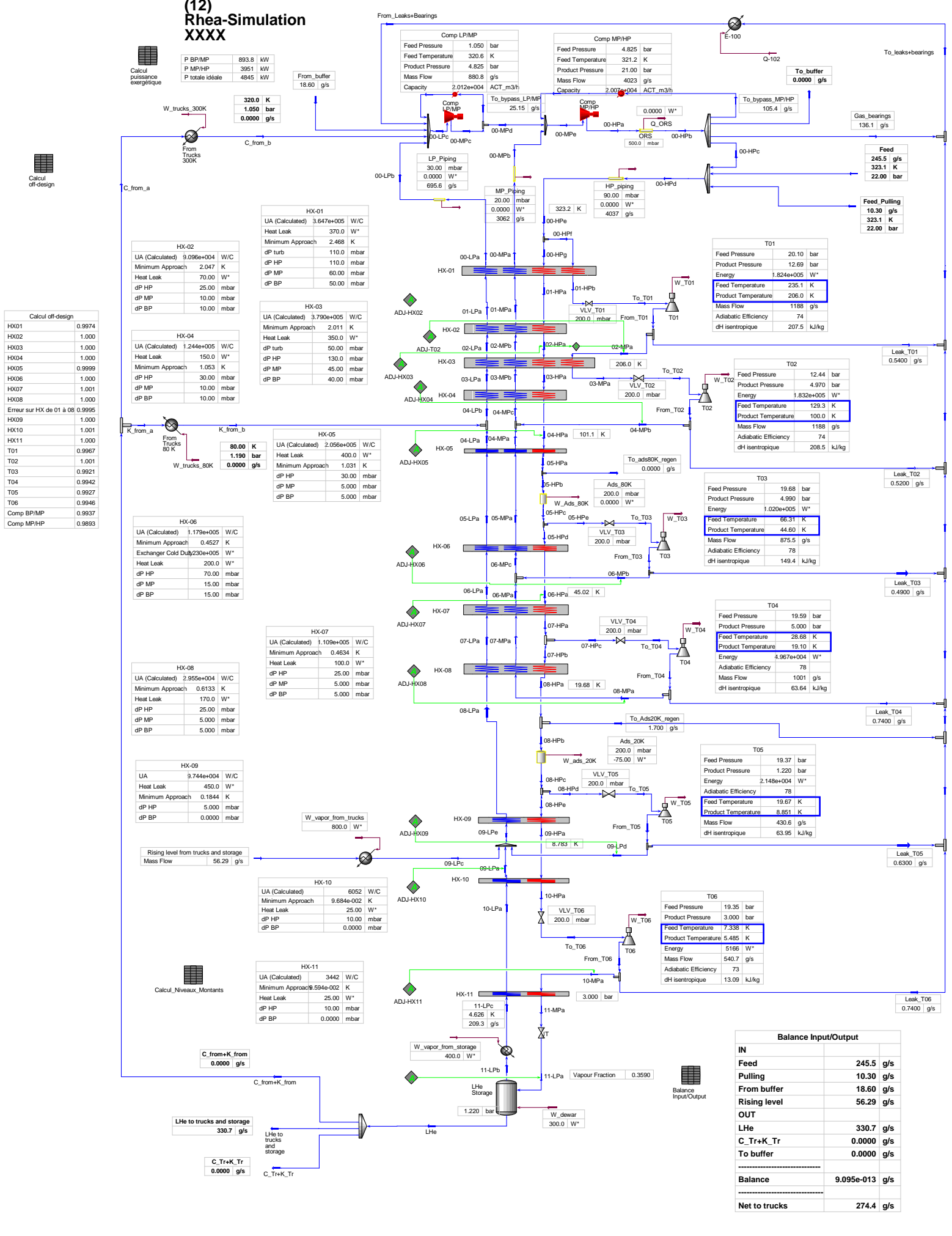
HX-11

UA (Calculated)	3512	W/C
Heat Leak	0.1002	K
Minimum Approach	25.00	W*
dP HP	10.00	mbar
dP MP	0.0000	mbar

Balance Input/Output

IN	
Feed	245.5 g/s
Pulling	10.30 g/s
From buffer	0.0000 g/s
Rising level	49.02 g/s
OUT	
LHe	287.7 g/s
C.Tr+K.Tr	0.6000 g/s
To buffer	16.50 g/s
Balance	8.740e-013 g/s
Net to trucks	239.3 g/s

# (12) Rhea-Simulation XXXX



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

# (12) Rhea-Simulation KXXX

Calcul puissance exigétique

P BP/MP	897.6	KW
P MP/HP	3982	KW
P totale idéale	4880	KW

Calcul off-design

HX01	1.005
HX02	1.000
HX03	1.000
HX04	0.9996
HX05	1.000
HX06	1.000
HX07	1.000
HX08	1.000
Erreur sur HX de 01 à 08	1.001
HX09	0.9998
HX10	0.9998
HX11	1.000
T01	0.9936
T02	1.000
T03	0.9918
T04	1.000
T05	1.001
T06	0.9985
Comp BP/MP	0.9974
Comp MP/HP	0.9966

Calcul off-design

HX01	1.005
HX02	1.000
HX03	1.000
HX04	0.9996
HX05	1.000
HX06	1.000
HX07	1.000
HX08	1.000
Erreur sur HX de 01 à 08	1.001
HX09	0.9998
HX10	0.9998
HX11	1.000
T01	0.9936
T02	1.000
T03	0.9918
T04	1.000
T05	1.001
T06	0.9985
Comp BP/MP	0.9974
Comp MP/HP	0.9966

Calcul Niveau\_Montants

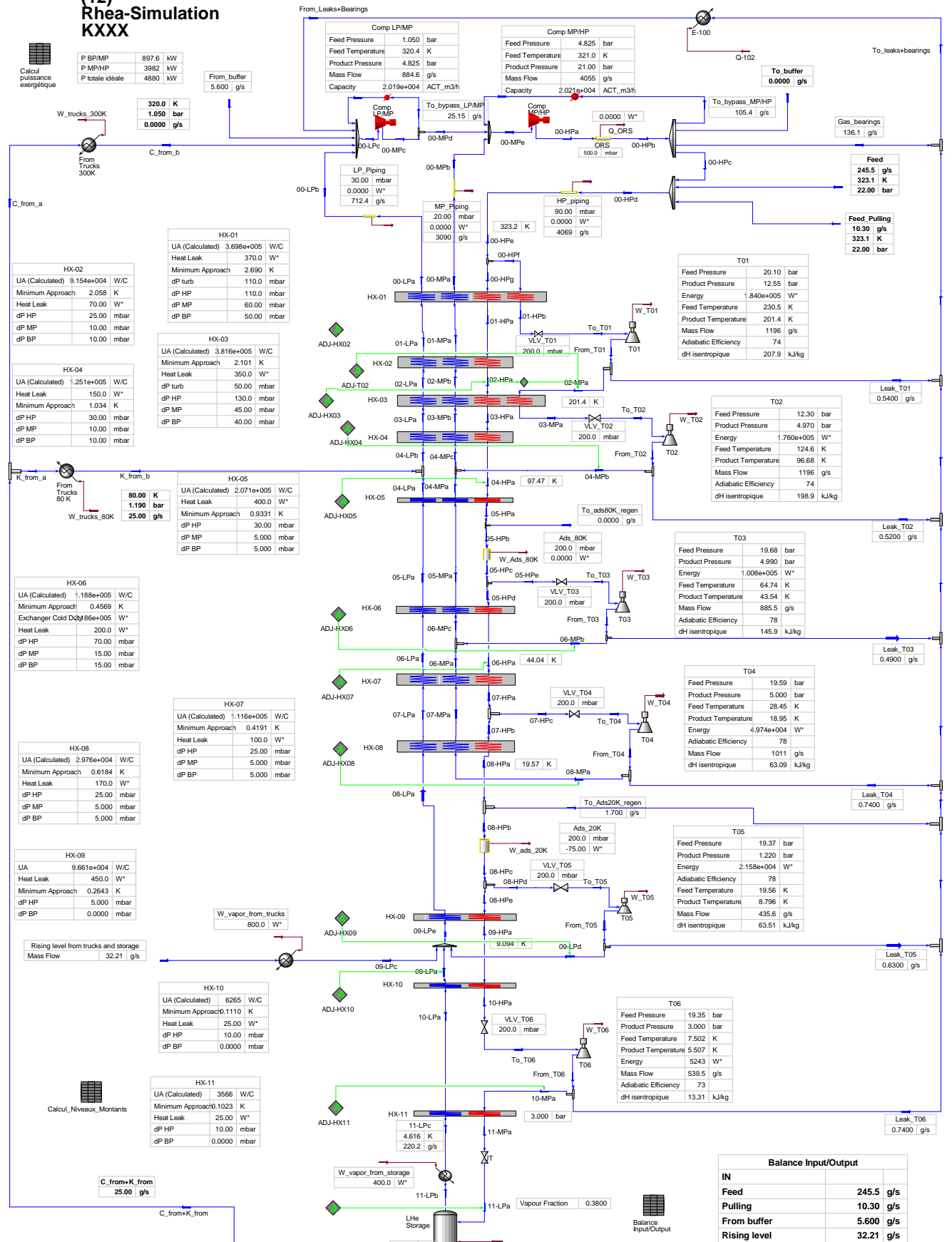
HX01	1.005
HX02	1.000
HX03	1.000
HX04	0.9996
HX05	1.000
HX06	1.000
HX07	1.000
HX08	1.000
Erreur sur HX de 01 à 08	1.001
HX09	0.9998
HX10	0.9998
HX11	1.000
T01	0.9936
T02	1.000
T03	0.9918
T04	1.000
T05	1.001
T06	0.9985
Comp BP/MP	0.9974
Comp MP/HP	0.9966

Calcul Niveau\_Montants

HX01	1.005
HX02	1.000
HX03	1.000
HX04	0.9996
HX05	1.000
HX06	1.000
HX07	1.000
HX08	1.000
Erreur sur HX de 01 à 08	1.001
HX09	0.9998
HX10	0.9998
HX11	1.000
T01	0.9936
T02	1.000
T03	0.9918
T04	1.000
T05	1.001
T06	0.9985
Comp BP/MP	0.9974
Comp MP/HP	0.9966

Calcul Niveau\_Montants

HX01	1.005
HX02	1.000
HX03	1.000
HX04	0.9996
HX05	1.000
HX06	1.000
HX07	1.000
HX08	1.000
Erreur sur HX de 01 à 08	1.001
HX09	0.9998
HX10	0.9998
HX11	1.000
T01	0.9936
T02	1.000
T03	0.9918
T04	1.000
T05	1.001
T06	0.9985
Comp BP/MP	0.9974
Comp MP/HP	0.9966



Balance Input/Output	
<b>IN</b>	
Feed	245.5 g/s
Pulling	10.30 g/s
From buffer	5.600 g/s
Rising level	32.21 g/s
<b>OUT</b>	
LHe	189.2 g/s
C. Tr+K. Tr	104.4 g/s
To buffer	0.0000 g/s
<b>Balance</b>	
	3.411e-013 g/s
<b>Net to trucks</b>	
	261.4 g/s

# (12) Rhea-Simulation CKXX

Calcul puissance électrique

P BP/MP	924.3 kW
P MP/HP	4013 kW
P totale idéale	4938 kW

W\_trucks\_300K

320.0 K
1.050 bar
36.10 g/s

C\_from\_a

320.0 K
1.050 bar
36.10 g/s

C\_from\_b

320.0 K
1.050 bar
36.10 g/s

HX-01

UA (Calculated)	3.689e+005 W/C
Heat Leak	370.0 W*
Minimum Approach	2.680 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)	9.162e+004 W/C
Minimum Approach	2.034 K
Heat Leak	70.00 W*
dP HP	25.00 mbar
dP MP	10.00 mbar
dP BP	10.00 mbar

HX-03

UA (Calculated)	3.820e+005 W/C
Minimum Approach	2.110 K
Heat Leak	350.0 W*
dP turb	50.00 mbar
dP HP	130.0 mbar
dP MP	45.00 mbar
dP BP	40.00 mbar

HX-04

UA (Calculated)	1.254e+005 W/C
Minimum Approach	1.027 K
Heat Leak	150.0 W*
dP HP	30.00 mbar
dP MP	10.00 mbar
dP BP	10.00 mbar

HX-05

UA (Calculated)	2.071e+005 W/C
Minimum Approach	0.9289 K
Heat Leak	400.0 W*
dP HP	30.00 mbar
dP MP	5.000 mbar
dP BP	5.000 mbar

HX-06

UA (Calculated)	1.188e+005 W/C
Minimum Approach	0.4448 K
Heat Leak	200.0 W*
dP HP	70.00 mbar
dP MP	15.00 mbar
dP BP	15.00 mbar

HX-07

UA (Calculated)	1.111e+005 W/C
Minimum Approach	0.4106 K
Heat Leak	100.0 W*
dP HP	25.00 mbar
dP MP	5.000 mbar
dP BP	5.000 mbar

HX-08

UA (Calculated)	2.965e+004 W/C
Minimum Approach	0.6326 K
Heat Leak	170.0 W*
dP HP	25.00 mbar
dP MP	5.000 mbar
dP BP	5.000 mbar

HX-09

UA (Calculated)	9.627e+004 W/C
Minimum Approach	0.2992 K
Heat Leak	450.0 W*
dP HP	5.000 mbar
dP MP	0.0000 mbar
dP BP	0.0000 mbar

HX-10

UA (Calculated)	6370 W/C
Minimum Approach	0.1181 K
Heat Leak	25.00 W*
dP HP	10.00 mbar
dP BP	0.0000 mbar

HX-11

UA (Calculated)	3621 W/C
Minimum Approach	0.1058 K
Heat Leak	25.00 W*
dP HP	10.00 mbar
dP BP	0.0000 mbar

W\_trucks\_80K

80.00 K
1.190 bar
25.00 g/s

W\_vapor\_from\_trucks

800.0 W*
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Rising level from trucks and storage

Mass Flow	24.90 g/s
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C\_from\_a

61.10 g/s
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C\_from\_b

61.10 g/s
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LHe to trucks and storage

146.2 g/s
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C\_Tr+K\_Tr

105.0 g/s
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C\_Tr+K\_Tr

105.0 g/s
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C\_Tr+K\_Tr

105.0 g/s
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C\_Tr+K\_Tr

105.0 g/s
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C\_Tr+K\_Tr

105.0 g/s
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C\_Tr+K\_Tr

105.0 g/s
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C\_Tr+K\_Tr

105.0 g/s
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C\_Tr+K\_Tr

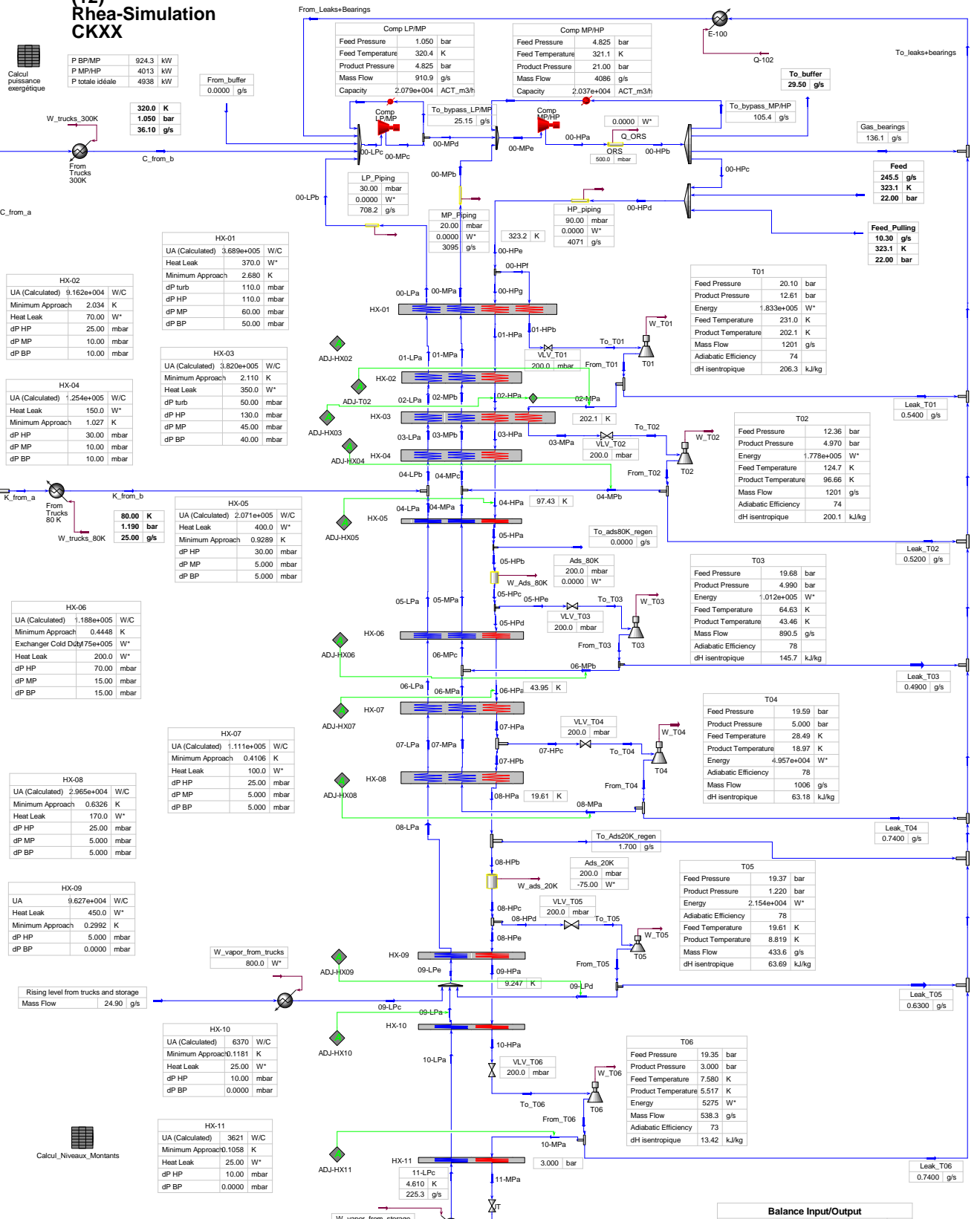
105.0 g/s
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C\_Tr+K\_Tr

105.0 g/s
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Calcul off-design

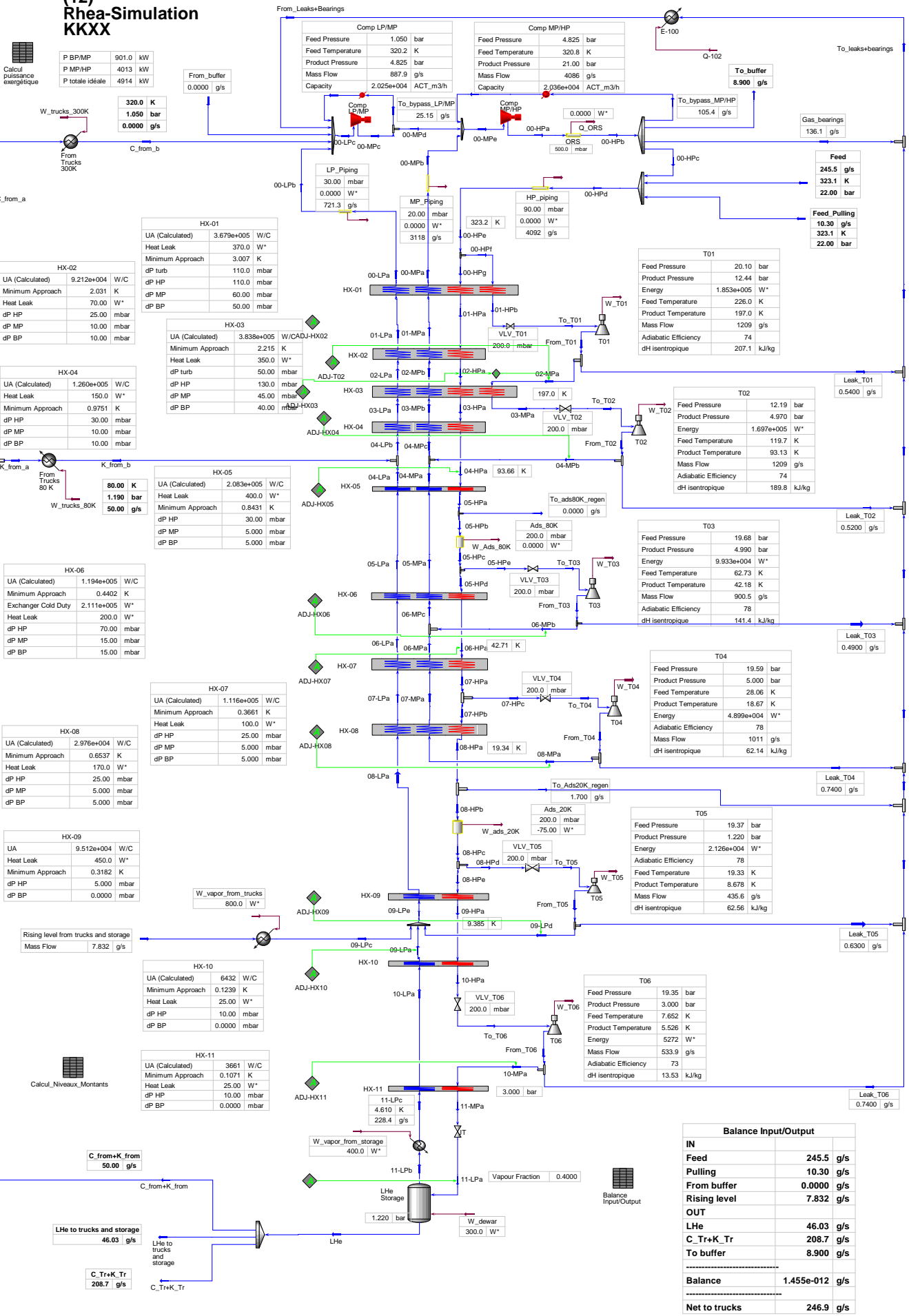
HX01	1.001
HX02	1.000
HX03	1.000
HX04	1.001
HX05	0.9997
HX06	1.000
HX07	0.9996
HX08	1.000
Erreur sur HX de 01 à 08	1.000
HX09	1.001
HX10	1.000
HX11	0.9992
T01	0.9989
T02	0.9997
T03	0.9986
T04	0.9958
T05	0.9978
T06	0.9994
Comp BP/MP	1.027
Comp MP/HP	1.024



Balance Input/Output

IN	
Feed	245.5 g/s
Pulling	10.30 g/s
From buffer	0.0000 g/s
Rising level	24.90 g/s
OUT	
LHe	146.2 g/s
C_Tr+K_Tr	105.0 g/s
To buffer	29.50 g/s
Balance	7.674e-013 g/s
Net to trucks	226.3 g/s

# (12) Rhea-Simulation KKXX



Calcul puissance energetique

P BP/MP	901.0	kW
P MP/HP	4013	kW
P totale ideale	4914	kW

Calcul off-design

HX01	0.9934
HX02	1.000
HX03	1.000
HX04	1.001
HX05	1.000
HX06	0.9999
HX07	1.000
HX08	1.000
Erreur sur HX de 01 à 080.9984	
HX09	1.001
HX10	1.000
HX11	1.000
T01	0.9948
T02	0.9999
T03	0.9932
T04	0.9928
T05	0.9944
T06	0.9939
Comp BP/MP	1.000
Comp MP/HP	1.003

Calcul off-design

HX-01	
UA (Calculated)	3.679e+005 W/C
Heat Leak	370.0 W*
Minimum Approach	3.007 K
dP turb	110.0 mbar
dP HP	110.0 mbar
dP MP	60.00 mbar
dP BP	50.00 mbar

Calcul off-design

HX-02	
UA (Calculated)	9.212e+004 W/C
Minimum Approach	2.031 K
Heat Leak	70.00 W*
dP HP	25.00 mbar
dP MP	10.00 mbar
dP BP	10.00 mbar

Calcul off-design

HX-03	
UA (Calculated)	3.838e+005 W/CADJ-HX02
Minimum Approach	2.215 K
Heat Leak	350.0 W*
dP turb	50.00 mbar
dP HP	130.0 mbar
dP MP	45.00 mbar
dP BP	40.00 mbar

Calcul off-design

HX-04	
UA (Calculated)	1.260e+005 W/C
Heat Leak	150.0 W*
Minimum Approach	0.9751 K
dP HP	30.00 mbar
dP MP	10.00 mbar
dP BP	10.00 mbar

Calcul off-design

HX-05	
UA (Calculated)	2.083e+005 W/C
Heat Leak	400.0 W*
Minimum Approach	0.8431 K
dP HP	30.00 mbar
dP MP	5.000 mbar
dP BP	5.000 mbar

Calcul off-design

HX-06	
UA (Calculated)	1.194e+005 W/C
Minimum Approach	0.4402 K
Exchanger Cold Duty	2.111e+005 W*
Heat Leak	200.0 W*
dP HP	70.00 mbar
dP MP	15.00 mbar
dP BP	15.00 mbar

Calcul off-design

HX-07	
UA (Calculated)	2.976e+004 W/C
Minimum Approach	0.6537 K
Heat Leak	170.0 W*
dP HP	25.00 mbar
dP MP	5.000 mbar
dP BP	5.000 mbar

Calcul off-design

HX-08	
UA (Calculated)	9.512e+004 W/C
Heat Leak	450.0 W*
Minimum Approach	0.3182 K
dP HP	5.000 mbar
dP BP	0.0000 mbar

Calcul off-design

HX-09	
UA (Calculated)	6432 W/C
Minimum Approach	0.1239 K
Heat Leak	25.00 W*
dP HP	10.00 mbar
dP BP	0.0000 mbar

Calcul off-design

HX-10	
UA (Calculated)	3661 W/C
Minimum Approach	0.1071 K
Heat Leak	25.00 W*
dP HP	10.00 mbar
dP BP	0.0000 mbar

Calcul off-design

HX-11	
UA (Calculated)	4.610 K
Minimum Approach	228.4 g/s
dP HP	4.610 K
dP BP	0.0000 mbar

Balance Input/Output

Balance Input/Output	
IN	
Feed	245.5 g/s
Pulling	10.30 g/s
From buffer	0.0000 g/s
Rising level	7.832 g/s
OUT	
LHe	46.03 g/s
C_Tr+K_Tr	208.7 g/s
To buffer	8.900 g/s
Balance	1.455e-012 g/s
Net to trucks	246.9 g/s

# (12) Rhea-Simulation LLLX

Calcul puissance exergétique

P BP/MP	900.0 kW
P MP/HP	3968 kW
P totale idéale	4868 kW

From\_trucks\_300K

320.0 K	1.050 bar	0.0000 g/s
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From Trucks 300K

320.0 K	1.050 bar	0.0000 g/s
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Calcul off-design

HX-02	
UA (Calculated)	9.119e+004 W/C
Minimum Approach	2.054 K
Heat Leak	70.00 W*
dP HP	25.00 mbar
dP MP	10.00 mbar
dP BP	10.00 mbar

HX-04	
UA (Calculated)	1.247e+005 W/C
Minimum Approach	1.062 K
Heat Leak	150.0 W*
dP HP	30.00 mbar
dP MP	10.00 mbar
dP BP	10.00 mbar

HX-05	
UA (Calculated)	2.062e+005 W/C
Minimum Approach	1.044 K
Heat Leak	400.0 W*
dP HP	30.00 mbar
dP MP	5.000 mbar
dP BP	5.000 mbar

HX-06	
UA (Calculated)	1.181e+005 W/C
Minimum Approach	0.4551 K
Heat Leak	200.0 W*
dP HP	70.00 mbar
dP MP	15.00 mbar
dP BP	15.00 mbar

HX-07	
UA (Calculated)	1.110e+005 W/C
Minimum Approach	0.4714 K
Heat Leak	100.0 W*
dP HP	25.00 mbar
dP MP	5.000 mbar
dP BP	5.000 mbar

HX-08	
UA (Calculated)	2.963e+004 W/C
Minimum Approach	0.6456 K
Heat Leak	170.0 W*
dP HP	25.00 mbar
dP MP	5.000 mbar
dP BP	5.000 mbar

HX-09	
UA (Calculated)	9.803e+004 W/C
Minimum Approach	0.455e-002 K
Heat Leak	450.0 W*
dP HP	5.000 mbar
dP BP	0.0000 mbar

HX-10	
UA (Calculated)	4921 W/C
Minimum Approach	298e-002 K
Heat Leak	25.00 W*
dP HP	10.00 mbar
dP BP	0.0000 mbar

HX-11	
UA (Calculated)	2801 W/C
Minimum Approach	156e-002 K
Heat Leak	25.00 W*
dP HP	10.00 mbar
dP BP	0.0000 mbar

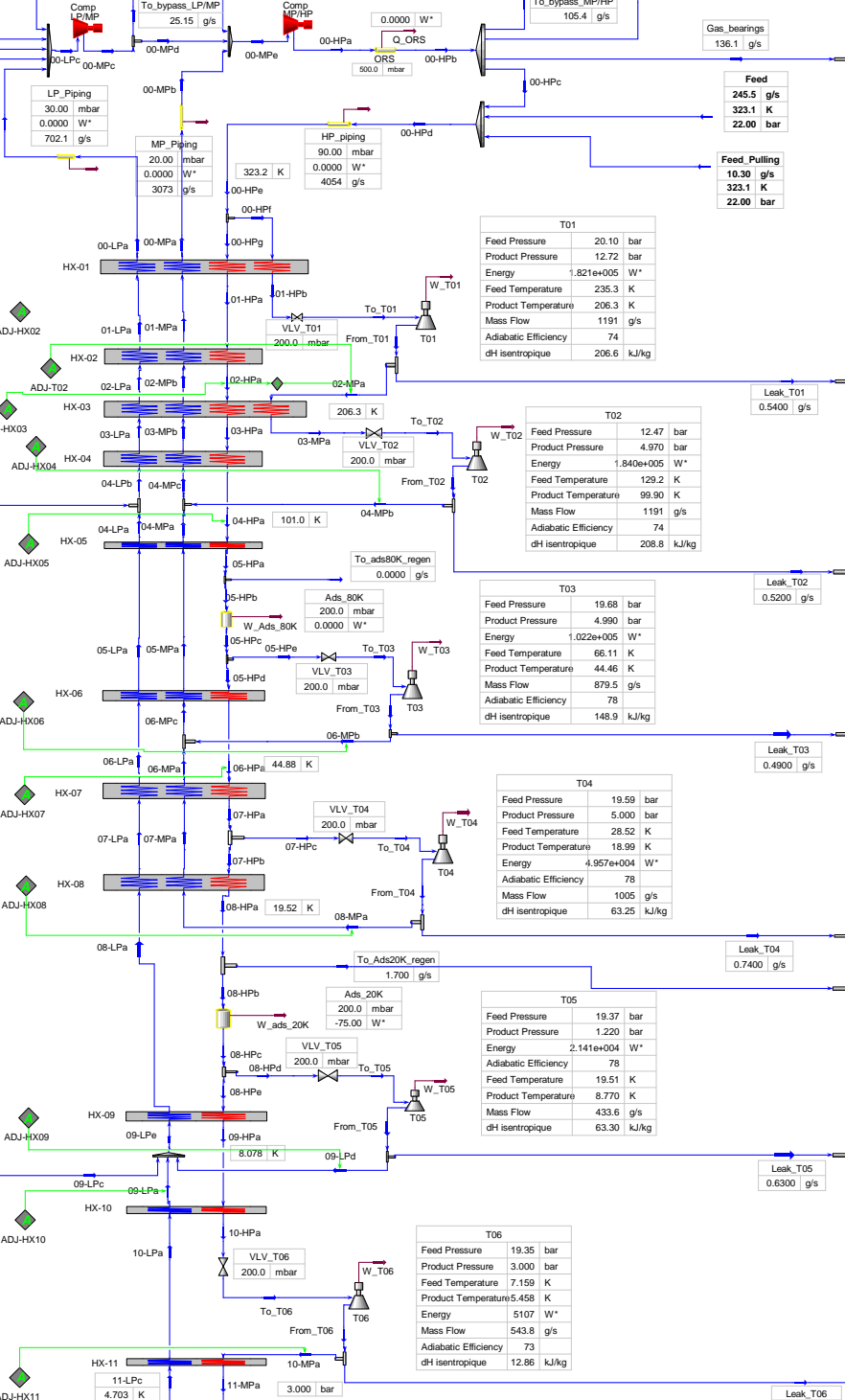
LHe to trucks and storage	664.5 g/s
C. Tr+K. Tr	0.0000 g/s

C. Tr+K. Tr	0.0000 g/s
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From\_Leaks+Bearings

Comp LP/MP	
Feed Pressure	1.050 bar
Feed Temperature	320.5 K
Product Pressure	4.825 bar
Mass Flow	886.9 g/s
Capacity	2.025e+004 ACT_m3/h

Comp MP/HP	
Feed Pressure	4.825 bar
Feed Temperature	321.2 K
Product Pressure	21.00 bar
Mass Flow	4040 g/s
Capacity	2.015e+004 ACT_m3/h



Balance Input/Output	
IN	
Feed	245.5 g/s
Pulling	10.30 g/s
From buffer	18.25 g/s
Rising level	113.1 g/s
OUT	
LHe	664.5 g/s
C. Tr+K. Tr	0.0000 g/s
To buffer	0.0000 g/s
Balance	-277.3 g/s
Net to trucks	551.4 g/s