Process Calculation
for De-Butanizer
2109/2209-V-105

C0	Approved for Construction	JW	30-Mar-10	CK	31-Mar-10	SM	01-Apr-10
REV.	DESCRIPTION	BY	DATE	BY	DATE	BY	DATE
		REVISED		CHECKED		APPROVAL	

I.O.O.C

National Iranian Oil Co.

شرکت نفت فلات قاره ایران

IRANIAN OFFSHORE OIL Co.

KHARG ISLAND GAS GATHERING & NGL RECOVERY PROJECT

EPC CONTRACT FOR ONSHORE RECEPTION FACILITIES, PIPELINE, NGL PROCESS, STORAGE AND EXPORT FACILITIES

IRITEC ایریتک — IRAN INTERNATIONAL ENGINEERING COMPANY — شرکت بین المللی مهندسی ایران

IRITEC – IRASCO CONSORTIUM

IRASCO s.r.l.

CONTRACT REF. NO.	KHG3-20-PR-CC-6012								
CONTRACT NO.	3660-85-2FG	SIGNATURE	DATE	IRITEC-IRASCO DOC. NO.					R
TDE ThermoDesign	DESIGNED	G.W.	04/01/10						
	CHECKED	[illegible]	3/31/10						
	APPROVED	[illegible]	4/06/10						

SUBCONTRACTOR REF. NO.	CLASS	STATUS	DOCUMENT NO.	SHEET	REV.
KHG3-2109-PR-CC-0009	I	C	KHG3-20-PR-CC-6012	1 of 13	C0

SHEET	REVISION						SHEET	REVISION					
.NO	C0	C1	C2	C3	C4	C5	.NO	C0	C1	C2	C3	C4	C5
1	X						25						
2	X						26						
3	X						27						
4	X						28						
5	X						29						
6	X						30						
7	X						31						
8	X						32						
9	X						33						
10	X						34						
11	X						35						
12	X						36						
13	X						37						
14							38						
15							39						
16							40						
17							41						
18							42						
19							43						
20							44						
21							45						
22							46						
23							47						
24							48						

Tower Profile Details-Peak Rate Summer, Maximum Methane Slippage

Column Summary

Stage	Temperature (°C)	Pressure (barg)	Liquid (kg/hr)	Vapour (kg/hr)	Feed (kg/hr)	Draws (kg/hr)
1	62.5	6.59	64,515	87,297	61,647	
2	64.1	6.59	64,862	90,165		
3	64.8	6.60	64,849	90,511		
4	65.4	6.60	64,786	90,498		
5	66.0	6.61	64,715	90,435		
6	66.6	6.61	64,639	90,364		
7	67.3	6.62	64,554	90,289		
8	68.2	6.62	64,450	90,204		
9	69.2	6.63	64,286	90,100		
10	70.6	6.63	63,822	89,936		
11	72.7	6.64	61,568	89,472		
12	78.4	6.64	65,279	87,218		
13	77.4	6.65	85,153	72,951	39,595 Feed	
14	78.6	6.66	85,093	71,208	(mixed Phase)	
15	80.5	6.66	85,467	71,148		
16	83.0	6.67	86,058	71,523		
17	85.7	6.67	86,837	72,113		
18	88.8	6.68	87,796	72,892		
19	91.9	6.68	88,900	73,851		
20	95.0	6.69	90,086	74,955		
21	97.9	6.69	91,272	76,141		
22	100.4	6.70	92,377	77,327		
23	102.6	6.70	93,343	78,432		
24	104.3	6.71	94,139	79,398		
25	105.8	6.71	94,761	80,194		
26	107.0	6.72	95,221	80,816		
27	108.0	6.72	95,537	81,276		
28	109.0	6.73	95,723	81,592		
29	110.0	6.73	95,773	81,778		
30	111.3	6.74	95,579	81,828		
31	113.3	6.75	94,506	81,635		
Reboiler	117.7	6.80		80,561		13,945 Bottom Product

Tower Profile Details-Peak Rate Summer, Maximum Methane Slippage

Vapour Transport Properties

Stage	Mole Wt.	Vapour Density (kg/m^3)	Vapour Viscosity (cP)	Vapour Thermal Conductivity (W/m-K)	Vapour Heat Capacity (kJ/kg-°C)
1	57.99	18.92	0.009	0.020	2.11
2	58.12	18.86	0.009	0.020	2.11
3	58.21	18.86	0.009	0.020	2.11
4	58.30	18.87	0.009	0.020	2.12
5	58.41	18.88	0.009	0.020	2.12
6	58.54	18.90	0.009	0.020	2.12
7	58.70	18.93	0.009	0.020	2.12
8	58.90	18.96	0.009	0.021	2.13
9	59.15	18.99	0.009	0.021	2.13
10	59.45	19.02	0.009	0.021	2.13
11	59.82	19.01	0.009	0.021	2.14
12	60.25	18.71	0.009	0.021	2.15
13	60.85	19.08	0.009	0.021	2.15
14	61.37	19.23	0.009	0.021	2.16
15	62.01	19.36	0.009	0.021	2.17
16	62.79	19.51	0.009	0.021	2.18
17	63.73	19.68	0.009	0.022	2.19
18	64.79	19.89	0.009	0.022	2.20
19	65.93	20.12	0.009	0.022	2.21
20	67.09	20.36	0.009	0.022	2.22
21	68.18	20.59	0.009	0.022	2.23
22	69.17	20.79	0.009	0.022	2.24
23	70.00	20.97	0.009	0.022	2.25
24	70.67	21.12	0.009	0.023	2.26
25	71.21	21.23	0.009	0.023	2.27
26	71.63	21.32	0.009	0.023	2.27
27	71.97	21.40	0.009	0.023	2.28
28	72.27	21.45	0.009	0.023	2.28
29	72.56	21.51	0.009	0.023	2.29
30	72.90	21.55	0.009	0.023	2.29
31	73.35	21.58	0.009	0.023	2.30

Tower Profile Details-Peak Rate Summer, Maximum Methane Slippage

Liquid Transport Properties

Stage	Surface Tension (dyne/cm)	Mole Wt.	Density (kg/m^3)	Viscosity (cP)	Thermal Conductivity (W/m-K)	Heat Capacity (kJ/kg-C)
1	7.31	58.17	518.8	0.118	0.078	2.69
2	7.22	58.30	517.8	0.117	0.078	2.70
3	7.21	58.43	517.9	0.117	0.078	2.70
4	7.21	58.57	518.2	0.117	0.078	2.70
5	7.21	58.76	518.5	0.117	0.078	2.70
6	7.21	58.98	518.9	0.117	0.078	2.70
7	7.20	59.27	519.4	0.117	0.078	2.70
8	7.20	59.62	520.0	0.117	0.078	2.70
9	7.19	60.06	520.7	0.117	0.078	2.70
10	7.18	60.59	521.3	0.117	0.078	2.70
11	7.12	61.24	521.5	0.116	0.078	2.70
12	6.72	62.06	517.2	0.113	0.076	2.73
13	7.15	63.41	525.3	0.118	0.078	2.70
14	7.19	63.98	526.6	0.118	0.078	2.70
15	7.17	64.67	527.1	0.118	0.078	2.70
16	7.13	65.49	527.5	0.117	0.078	2.71
17	7.07	66.41	527.7	0.117	0.078	2.71
18	7.00	67.40	527.7	0.116	0.078	2.72
19	6.93	68.40	527.5	0.115	0.077	2.72
20	6.85	69.34	527.0	0.114	0.077	2.73
21	6.76	70.18	526.4	0.113	0.077	2.74
22	6.69	70.90	525.7	0.112	0.077	2.75
23	6.62	71.48	525.0	0.111	0.077	2.76
24	6.56	71.94	524.4	0.111	0.077	2.76
25	6.52	72.30	523.8	0.110	0.077	2.77
26	6.48	72.59	523.4	0.110	0.076	2.77
27	6.46	72.84	523.1	0.110	0.076	2.78
28	6.44	73.10	522.8	0.110	0.076	2.78
29	6.42	73.39	522.7	0.110	0.076	2.78
30	6.40	73.78	522.7	0.110	0.076	2.79
31	6.36	74.36	522.5	0.110	0.076	2.80

Tower Profile Details-Peak Rate Summer, Maximum Methane Slippage

K Values

Stage	Light Key n-butane	Heavy Key i-pentane
1	0.947	0.616
2	0.953	0.598
3	0.958	0.589
4	0.964	0.585
5	0.970	0.583
6	0.978	0.583
7	0.987	0.584
8	0.999	0.588
9	1.015	0.593
10	1.034	0.599
11	1.059	0.606
12	1.103	0.630
13	1.168	0.681
14	1.193	0.712
15	1.222	0.744
16	1.256	0.777
17	1.297	0.812
18	1.342	0.849
19	1.390	0.886
20	1.438	0.922
21	1.483	0.955
22	1.523	0.984
23	1.557	1.008
24	1.584	1.028
25	1.607	1.043
26	1.624	1.056
27	1.639	1.066
28	1.651	1.075
29	1.664	1.085
30	1.678	1.096
31	1.699	1.111

Feed Stream Compositions

	Feed Tray # 13	Reflux Tray #1
Vapour Fraction	0.473	0.000
Temperature (°C)	80.09	55.40
Pressure (bar g)	6.79	10.28
Total Molar Flow Rate (kgmole/hr)	625	1063
Comp Mole Frac (H2O)	0.000	0.000
Comp Mole Frac (Nitrogen)	0.000	0.000
Comp Mole Frac (CO2)	0.000	0.000
Comp Mole Frac (H2S)	0.000	0.000
Comp Mole Frac (Methane)	0.000	0.000
Comp Mole Frac (Ethane)	0.000	0.000
Comp Mole Frac (Propane)	0.012	0.017
Comp Mole Frac (i-Butane)	0.208	0.294
Comp Mole Frac (n-Butane)	0.484	0.683
Comp Mole Frac (i-Pentane)	0.109	0.006
Comp Mole Frac (n-Pentane)	0.115	0.001
Comp Mole Frac (n-Hexane)	0.058	0.000
Comp Mole Frac (n-Heptane)	0.013	0.000
Comp Mole Frac (n-Octane)	0.002	0.000
Comp Mole Frac (n-Nonane)	0.000	0.000
Comp Mole Frac (COS)	0.000	0.000
Comp Mole Frac (M-Mercaptan)	0.000	0.000
Comp Mole Frac (E-Mercaptan)	0.000	0.000
Comp Mole Frac (CS2)	0.000	0.000
Comp Mole Frac (2C3Mercaptan)	0.000	0.000
Comp Mole Frac (M-E-Sulfide)	0.000	0.000
Comp Mole Frac (n-Decane)	0.000	0.000
Comp Mole Frac (nPMercaptan)	0.000	0.000
Comp Mole Frac (2-M-1C3Thiol)	0.000	0.000
Comp Mole Frac (diMdiSulphid)	0.000	0.000
Comp Mole Frac (Benzene)	0.000	0.000
Comp Mole Frac (Toluene)	0.000	0.000
Comp Mole Frac (nBMercaptan)	0.000	0.000

Product Stream Compositions

	Ovhd Liquid	Bottom Liquid
Vapour Fraction	0.00	0.00
Temperature (°C)	55.40	117.69
Pressure (bar g)	10.28	6.80
Total Molar Flow Rate (kgmole/hr)	442	183
Comp Mole Frac (H2O)	0.000	0.000
Comp Mole Frac (Nitrogen)	0.000	0.000
Comp Mole Frac (CO2)	0.000	0.000
Comp Mole Frac (H2S)	0.000	0.000
Comp Mole Frac (Methane)	0.000	0.000
Comp Mole Frac (Ethane)	0.000	0.000
Comp Mole Frac (Propane)	0.012	0.000
Comp Mole Frac (i-Butane)	0.208	0.000
Comp Mole Frac (n-Butane)	0.484	0.003
Comp Mole Frac (i-Pentane)	0.109	0.358
Comp Mole Frac (n-Pentane)	0.115	0.391
Comp Mole Frac (n-Hexane)	0.058	0.197
Comp Mole Frac (n-Heptane)	0.013	0.044
Comp Mole Frac (n-Octane)	0.002	0.007
Comp Mole Frac (n-Nonane)	0.000	0.000
Comp Mole Frac (COS)	0.000	0.000
Comp Mole Frac (M-Mercaptan)	0.000	0.000
Comp Mole Frac (E-Mercaptan)	0.000	0.000
Comp Mole Frac (CS2)	0.000	0.000
Comp Mole Frac (2C3Mercaptan)	0.000	0.000
Comp Mole Frac (M-E-Sulfide)	0.000	0.000
Comp Mole Frac (n-decane)	0.000	0.000
Comp Mole Frac (nPMercaptan)	0.000	0.000
Comp Mole Frac (2-M-1C3Thiol)	0.000	0.000
Comp Mole Frac (diMdiSulphid)	0.000	0.000
Comp Mole Frac (Benzene)	0.000	0.000
Comp Mole Frac (Toluene)	0.000	0.000
Comp Mole Frac (nBMercaptan)	0.000	0.000

TRAY EFFICIENCY CALCULATION

Correlation:	O'Connell
Tower	De-Butanizer
Tag:	2109-V-105 /2209-V-105
Light Key:	n-butane
Heavy Key:	i-pentane

O'Connell Equation:

$$E_{oc} = 0.492(\mu_L \alpha)^{-0.245}$$

Column Top Temperature:	62.5	°C	
Column Bottom Temperature:	113.3	°C	
Avg Column Temperature:	87.9	°C	~Stage 17-18
Liquid Viscosity at Avg Column T:	0.116	cP	

Relative Volatility

		@ Stg 17		@ Stg 18		
		k	T	k	T	@ Tavg
Light Key	n-butane	1.30	85.74	1.34	88.77	1.33
Heavy Key	i-pentane	0.81	85.74	0.85	88.77	0.84
α						1.58

Thus Eoc	74%	(Equation Accuracy, +/- 10%)
TDE Recommendation	**67%**	(Based on TDE experience)
Theoretical Stages	21	(Including Reboiler)
Therefore # Real Trays	30	
Number of Feed Trays	1	
Total Number of Trays	**31**	

Notes

IRITEC – IRASCO CONSORTIUM

KHARG ISLAND GAS GATHERING & NGL RECOVERY PROJECT

National Iranian Oil Co. — شرکت نفت فلات قاره ایران — IRANIAN OFFSHORE OIL Co.

TDE ThermoDesign

Process CC De-Butanizer 2109/2209-V-105

Document Number	REV.	SHEET NO.
KHG3-20-PR-CC-6012	C0	10 of 13

Reboiler Hydraulic Calculation - Refer to Sketch

	14"-P-212804-D1A-HC	16"-P-212805-D1A-HC	4"-P-212806-D1A-HC
Line number:			
Pipe OD:	14 in. = 355.60 mm	16 in. = 406.40 mm	4.5 in. = 114.30 mm
Wall Thk:	0.312 in. = 7.92 mm	0.3 in. = 7.92 mm	0.24 in. = 6.02 mm
Pipe ID:	13.38 in. = 339.75 mm	15 in. = 390.55 mm	4.03 in. = 102.26 mm

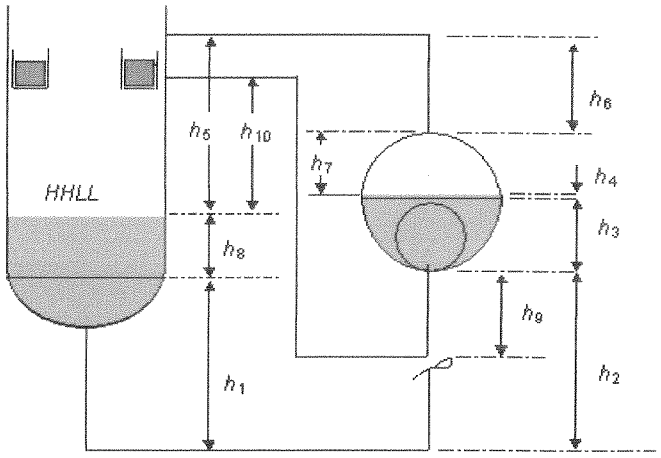
	Segment 1				Segment 2				Segment 3			
			Equivalent Length				Equivalent Length				Equivalent Length	
Fittings	Qty	L/D	Feet	Meters	Qty	L/D	Feet	Meters	Qty	L/D	Feet	Meters
90 degree 1.5 r elbow	0	20	0.0	0.0	0	20	0.0	0.0	0	20	0.0	0.0
45 degree 1.5 r elbow	0	15	0.0	0.0	0	15	0.0	0.0	0	15	0.0	0.0
90 degree LR 5.0 r elbow	9	16	160.5	48.9	4	16	82.0	25.0	2	16	10.7	3.3
Tee flow through run	0	20	0.0	0.0	0	20	0.0	0.0	0	20	0.0	0.0
Tee flow through branch	1	65	72.5	22.1	0	65	0.0	0.0	1	65	21.8	6.6
Return bend	0	28	0.0	0.0	0	28	0.0	0.0	0	28	0.0	0.0
Valves												
Globe conventional fully open	0	340	0.0	0.0	0	340	0.0	0.0	0	340	0.0	0.0
Globe Y 45 deg. fully open	0	160	0.0	0.0	0	160	0.0	0.0	0	160	0.0	0.0
Gate conventional fully open	0	13	0.0	0.0	0	13	0.0	0.0	0	13	0.0	0.0
Check conventional swing	0	135	0.0	0.0	0	135	0.0	0.0	0	135	0.0	0.0
Clearway swing	0	50	0.0	0.0	0	50	0.0	0.0	0	50	0.0	0.0
Inline ball	1	15	16.7	5.1	1	15	19.2	5.9	1	15	5.0	1.5
Butterfly 6" & > fully open	0	20	0.0	0.0	0	20	0.0	0.0	0	20	0.0	0.0
Length of Straight pipe	16.53		54.2	16.5	10.8		35.4	10.8	11.6		37.9	11.6
Misc												
Stainer - Y or Bucket Type	0	250	0.0	0.0	0	250	0.0	0.0	0	250	0.0	0.0
Suction Nozzle	0	32	0.0	0.0	0	32	0.0	0.0	0	32	0.0	0.0
	0		0.0	0.0	0		0.0	0.0	0		0.0	0.0
	0		0.0	0.0	0		0.0	0.0	0		0.0	0.0
Total			303.9	92.6			136.6	41.6			75.5	23.0

Taken from GPSA Page 17-6 and CRANE PAPER 410-C page A-30

Sketch

Geometry	**Inch**	**mm**	
Reboiler Diameter	81	2045	
Height to Top of Weir	40	1012.7	h_3
Tower Installation Height (from base line)	168	4277	h_1
Reboiler Installation Height (from base line)	202	5127	h_2
HLL-Vapour Return Nozzle	106	2685	h_5
Vertical Height of Inlet Line Under Reboiler	59	1500	h_9
HHLL - Liquid Inlet Nozzle	96	2427	h_{10}
Liquid Level in Tower (from bottom to HHLL)	57.1	1450	h_8
Weir Crest	1	25.4	h_4
Vertical Height of Reboiler-Vapour Return Nozzle	48.8	1240	h_6
Vertical Height of Vapor Phase	39.6	1007	h_7
Tower Diameter (bottom part)	85	2150	

Sketch



PERFORMANCE:

Pressure Balance Deviation **6.75 ft** **Loop 1** **0.82 ft** **Loop 2**

Must be greater than zero for reboiler to work

Must be greater than zero for production back to Tower

LINE SIZE AND FRICTION PRESSURE DROP

	Inlet Line		Outlet Vapour Line		Liquid Return Line	
Flow rate:	181 m^3/h =	208350 lb/hr	3724 m^3/h =	177606 lb/hr	27 m^3/h =	30743 lb/hr
Density:	522.5 kg/m^3	32.62 lb/ft^3	21.6 kg/m^3	1.35 lb/ft^3	525.1 kg/m^3	32.78 lb/ft^3
Viscosity:	0.110 cp		0.009 cp		0.112 cp	
Mixed density in Boiling Area	25.20 kg/m^3	1.57 lb/ft^3				

	Inlet Line Size and dp		Outlet Line Size and dp		Return Line Size and dp	
Pipe ID:	13.38 in. in	339.75 mm	15 in. in	390.55 mm	4.03 in. in	102.26 mm
Reynold # :	8.9E+05		8.E+06		4.E+05	
Steel Roughness Factor:	0.0020 in	0.05 mm	0.0020 in	0.05 mm	0.0020 in	0.05 mm
Fric. Fac. f:	0.0142		0.0128		0.0177	
Press. drop:	0.015 psi/100ft	0.0034 bar/100m	0.116 psi/100ft	0.0263 bar/100m	0.162 psi/100ft	0.0367 bar/100m
Velocity:	1.82 ft/s	0.55 m/s	28.34 ft/s	8.64 m/s	2.95 ft/s	0.90 m/s
Equip. L:	303.9 ft	92.6 m	136.6 ft	41.6 m	75.5 ft	23.0 m
Total dP:	0.045 psi	0.003 bar	0.159 psi	0.011 bar	0.123 psi	0.008 bar
Total Head loss of Liquid:	0.20 ft	0.06 m	0.70 ft	0.21 m	0.54 ft	0.16 m

Friction Factor:

Iter 1	0.014388581 in.	0.012779327 in.	0.018065362 in.
Iter 2	0.014177	0.012755	0.017726
Iter 3	0.014185	0.012755	0.017735

HX Pressure Drop

HX DP (From TASC)	0.360	Psi	0.0249	bar
Fouling Allowance	0.050	Psi	0.0034	bar
Others				
Total Head loss of Liquid:	1.81	ft	0.55	m

Hydraulic Balance	LOOP 1 - Reboiler Circulation Line	LOOP 2 - Liquid Return Line
Available Inlet Head	9.77 ft of liquid	20.14 ft of liquid
Outlet Return Head	-0.31 ft of liquid	-18.79 ft of liquid
Friction Head Loss	-2.71 ft of liquid	-0.54 ft of liquid
Hydraulic Balance	6.75 ft of liquid	0.82 ft of liquid

Vapour Line Velocity Check

Max allowed Velocity $\sqrt{\frac{4000}{\rho_v}}$ = 54.42 ft/s

Actual Vapour Velocity = 28.3 ft/s

Velocity is Acceptable

Note:

1. The tower installation height: **4.277** meter (Ground to TS)
2. The reboiler installation height: **5.127** meter (Ground to Bottom line)

SULTECH 6.4

SULZER Sulzer Chemtech

Reference:	2129610 KHG-07-069	
Customer:	Thermo Design Engineering	
Service:	De-butanizer	
Item:	1 2109/2209-V-105	
Date Run:	24-0ct-2009	

TRAY DESIGN Section 1

Geometry: Tr.1-31

Deck Type:	MVG	Tray Thickness [mm]:	2.0000
Number of Passes:	2	Material:	410 S
Inner Diameter [mm]:	2150	Tower Area [m^2]:	3.63
Tray Spacing [mm]:	610	Active Area [m^2]:	2.559
Section Height [m]:	18.910	Active Area [%]:	70.49

Downcomer Dimensional Data

Type: STANDARD:	Side	Center
Top Width [mm]:	330	330
Bottom Width [mm]:	210	170
Clearance Height [mm]:	40	40
Outlet Weir Height [mm]:	50	50
Outlet Weir Length [mm]:	1550	4249
Inlet Weir Height [mm]:	0	0
Rec. Pan Depth [mm]:	0	0
Pan Width [mm]:	0	0
Radius Tip:	No	No

Downcomer Calculated Output

Downcomer Top Area [m^2]:	0.35	Downcomer Area [m^2]:	0.71
Downcomer Bottom Area [m^2]:	0.18	Downcomer Area [%]:	19.45

Fluid Data: Fluid Tr.1-31	SUMAX@2	SUMAX@30	SUMIN@2	SUMIN@30	WIMAX@2	WIMAX@30
Gas:						
Flow Multiplier [%]:	100	100	100	100	100	100
Mult. Gas Rate [kg/h]:	90240.0	82110.0	90250.0	82110.0	76520.0	69400.0
Density [kg/m^3]:	18.860	21.650	18.860	21.650	18.860	21.650
Viscosity [cP]:	0.0091	0.0091	0.0087	0.0091	0.0091	0.0091
QV [m^3/s]:	1.33	1.05	1.33	1.05	1.13	0.89
Liquid:						
Flow Multiplier [%]:	100	100	100	100	100	100
Mult. Liquid Rate [kg/h]:	64940.0	95880.0	64940.0	95880.0	53660.0	80040.0
Density [kg/m^3]:	517.80	522.40	517.80	522.40	517.80	522.30
Surface Tension [mN/m]:	7.22	6.38	7.22	6.38	7.22	6.38
Viscosity [cP]:	0.117	0.110	0.117	0.110	0.117	0.110
QL [m^3/h]:	125.41	183.53	125.41	183.53	103.63	153.24
System Factor:	1.00	1.00	1.00	1.00	1.00	1.00
Calculated Output						
Jet Flood [%]:	71	62	71	62	59	52
Downcomer Flood [%]:	33	51	33	51	28	42
Downcomer Froth Backup [%]:	45	48	45	48	36	39
Downcomer Clear Liquid [mm]	155.81	171.12	155.58	171.12	128.53	144.46
Weir Loading [m^3/mh]:	40.46	59.21	40.46	59.21	33.43	49.43
Dry Drop [mmH_20]:	39.68	28.62	39.69	28.62	28.53	20.45
Pressure Drop [mbar]:	5.26	4.6	5.26	4.6	4.18	3.82

Number of trays: 31

1	Reference:	2129610 KHG-07-069	SULTECH 6.4	SULZER Sulzer Chemtech
2	Customer:	Thermo Design Engineering		
3	Service:	De-butanizer		
4	Item:	1 2109/2209-V-105		
5	Date Run:	24-0ct-2009		

TRAY DESIGN Section 1

Geometry: Tr.1-31

Deck Type:	MVG	Tray Thickness [mm]:	2.0000
Number of Passes:	2	Material:	410 S
Inner Diameter [mm]:	2150	Tower Area [m^2]:	3.63
Tray Spacing [mm]:	610	Active Area [m^2]:	2.559
Section Height [m]:	18.910	Active Area [%]:	70.49

Downcomer Dimensional Data

Type: STANDARD:	Side	Center
Top Width [mm]:	330	330
Bottom Width [mm]:	210	170
Clearance Height [mm]:	40	40
Outlet Weir Height [mm]:	50	50
Outlet Weir Length [mm]:	1550	4249
Inlet Weir Height [mm]:	0	0
Rec. Pan Depth [mm]:	0	0
Pan Width [mm]:	0	0
Radius Tip:	No	No

Downcomer Calculated Output

Downcomer Top Area [m^2]:	0.35	0.71	Downcomer Area [m^2]:	0.71
Downcomer Bottom Area [m^2]:	0.18	0.37	Downcomer Area [%]:	19.45

Fluid Data: Fluid Tr.1-31	WIMIN@2	WIMIN@30	TD@2	TD@30
Gas:				
Flow Multiplier [%]:	100	100	100	100
Mult. Gas Rate [kg/h]:	76530.0	69410.0	38260.0	34700.0
Density [kg/m^3]:	18.86	21.65	18.88	21.65
Viscosity [cP]:	0.0087	0.0091	0.0087	0.0091
QV [m^3/s]:	1.13	0.89	0.56	0.45
Liquid:				
Flow Multiplier [%]:	100	100	100	100
Mult. Liquid Rate [kg/h]:	53660.0	80040.0	26830.0	40020.0
Density [kg/m^3]:	517.80	522.30	517.80	522.30
Surface Tension [mN/m]:	7.22	6.38	7.22	6.38
Viscosity [cP]:	0.117	0.11	0.117	0.11
QL [m^3/h]:	103.63	153.24	51.81	76.62
System Factor:	1.00	1.00	1.00	1.00
Calculated Output				
Jet Flood [%]:	59	52	29	25
Downcomer Flood [%]:	28	42	14	21
Downcomer Froth Backup [%]:	36	39	18	21
Downcomer Clear Liquid [mm]	128.54	144.46	82.04	98.77
Weir Loading [m^3/mh]:	33.43	49.43	16.71	24.72
Dry Drop [mmH_20]:	28.54	20.45	7.13	5.11
Pressure Drop [mbar]:	4.18	3.82	2.21	2.43

Number of trays: 31