

DOCUMENT TYPE:



DOCUMENT TITLE:

Material and Energy Balance

Z	Apr-2019	MMTE	Shaghaghi	M.MOHAMMADZADEH	GISD	-	AS BUILT
4	Aug-2018	MMTE	MMTE	M.MOHAMMADZADEH	GISD	-	Issue For Construction
3	May-2015	MMTE	M.MOHAMMADZADEH	H.KIOMARSI	GISD	-	Issue For Construction
2	Mar-2015	MMTE	M.MOHAMMADZADEH	H.KIOMARSI	GISD	-	Issue For Construction
1	Jan-2014	MMTE	M.MOHAMMADZADEH	H.KIOMARSI	GISD	-	Issue For Construction
REV.	DATE	PRE.	CHK.	APP.	Client	Description	Purpose of Issue
		CONTRACTOR					



PROJECT TITLE :

KOWSAR GISD MEGA MODULE PROJECT

Client :	Contractor:
	 MINES & METALS TECHNOLOGICAL ENGINEERING CO. MMTE

Client's Project	Project Code	Main Contractor	Area Code	Plant Group	Equipment Code	Document Type	Engineering Discipline	Serial No.
GISD	7-2	119	1002	7	AA	05	P	100
	NAME		DATE		MMTE No.		SHEET	REV.
PREPARED	MMTE		Jan-2014		KGMM PG00P1100		46	Z
CHECKED	M.MOHAMMADZADEH		Jan-2014					
APPROVED	H.KIOMARSI		Jan-2014					

This document and the information disclosed are the property of MMTE and are not to be used to furnish any information for making of documents or apparatus except where approved by written agreement.

		<h1 style="text-align: center;">KOWSAR GISD MEGA MODULE PROJECT</h1>		 <p style="text-align: center;">MMTE</p>	
DOCUMENT TITLE		Document No:		Rev.	
Material and Energy Balance		Client Document No.:	<i>GISD7-211910027AA05P100</i>		Z
		MMTE Document No.:	<i>KGMMPG00P1100</i>		
				DATE: Apr.2019	
				Page 2 of 46	

REVISION RECORD SHEET

Page	Rev.01	Rev.02	Rev.03	Rev.04	Rev.Z	
01	x	x				
02	x	x				
03	x	x				
04	x	x				
05	x	x				
06	x	x				
07	x	x				
08	x	x				
09	x	x				
10	x	x				
11	x	x				
12	x	x				
13	x	x				
14	x	x				
15	x	x				
16	x	x				
17	x	x				
18	x	x				
19	x	x				
20	x	x				
21	x	x	x			
22	x	x				
23	x	x				
24	x	x				
25	x	x				
26	x	x				
27	x	x		x		
28	x	x		x		
29	x	x		x		
30	x	x		x		
31	x	x		x		
32	x	x				
33	x	x		x		
34	x	x		x		
35	x	x		x		
36	x	x				
37	x	x				
38	x	x				
39	x	x				
40	x	x				
41	x	x				
42	x	x				
43	x	x				
44	x	x				
45	x	x				
46	x	x				
47						
48						
49						
50						

Page	Rev.01	Rev.02	Rev.03	Rev.04	Rev.Z	
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						

Note: This Table is use for External Comments.

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE			Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	z	Page 3 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Top Gas	Process Gas Compressor Feed	1ST STAGE PROCESS GAS COMPRESSOR OUTPUT(EA)	1ST STAGE PROCESS GAS DAMPENERS OUTPUT(EA)	2ND STAGE PROCESS GAS COMPRESSOR OUTPUT(EA)	2ND STAGE PROCESS GAS DAMPENERS OUTPUT
Stream Name	101	102	103	104	105	106
Flow rate(NCMH) for 250 tph	426,882	245,998	89,871	127,199	136,139	259,672
Temperature, C	410.0	51.6	69.4	69.2	80.7	80.6
Pressure, Bar G	0.328	0.234	1.153	1.139	2.063	2.044
Max Flow Rate, NCMH	462,038	293,900	108,521	153,600	165,239	315,200
Max Temperature, C	800	58	75	75	90	90
Max Pressure, Bar G	0.674	0.588	1.450	1.450	2.433	2.433
Composition						
CO	20.10	23.21	21.18	22.45	20.97	21.99
CO2	14.92	17.22	15.71	16.65	15.56	16.31
H2	35.36	40.84	37.26	39.49	36.90	38.69
H2O	24.26	12.54	20.20	15.43	20.98	17.15
N2	3.19	3.68	3.36	3.56	3.33	3.49
CH4	2.17	2.51	2.29	2.42	2.26	2.37
C2H6	0.00	0.00	0.00	0.00	0.00	0.00
C3H8	0.00	0.00	0.00	0.00	0.00	0.00
C4H10	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
O2	0.00	0.00	0.00	0.00	0.00	0.00
S.G (@AIR)	0.642	0.644	0.642	0.644	0.642	0.643
Molecular Weight g/g-mole	18.520	18.600	18.550	18.580	18.540	18.570
Enthalpy Kcal/NCM						
HHV Kcal/NCM	1983.914	2224.160	2067.519	2164.626	2050.615	2129.865
LHV Kcal/NCM	1704.640	1968.504	1796.252	1903.640	1777.676	1864.859
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 4 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Process Gas Recycle To Top Gas Scrubber	Process Gas to bustle gas	FORCED COOLING	PROCESS GAS TO MIST ELIMINATOR	PROCESS GAS TO FEED GAS MIXER	Feed gas to 1st stage preheat inlet
Stream Name	107	108	111	112	113	115
Flow rate(NCMH) for 250 tph	15,853.146	0	0	243,819	243,819	292,671
Temperature, C	80.6	80.6	80.6	80.6	80.6	149.8
Pressure, Bar G	2.044	2.044	2.044	2.044	1.997	1.987
Max Flow Rate, NCMH	284,760	35,294	176,471	263,898	263,898	316,773
Max Temperature, C	800	90	90	90	90	152
Max Pressure, Bar G	2.433	2.433	2.433	2.433	2.433	2.433
Composition						
CO	21.99	21.99	21.99	21.99	21.99	18.32
CO2	16.31	16.31	16.31	16.31	16.31	13.64
H2	38.69	38.69	38.69	38.69	38.69	32.23
H2O	17.15	17.15	17.15	17.15	17.15	14.28
N2	3.49	3.49	3.49	3.49	3.49	3.91
CH4	2.37	2.37	2.37	2.37	2.37	16.67
C2H6	0.00	0.00	0.00	0.00	0.00	0.53
C3H8	0.00	0.00	0.00	0.00	0.00	0.22
C4H10	0.00	0.00	0.00	0.00	0.00	0.12
C5+	0.00	0.00	0.00	0.00	0.00	0.08
O2	0.00	0.00	0.00	0.00	0.00	0.00
S.G (@AIR)	0.643	0.643	0.643	0.643	0.643	0.641
Molecular Weight g/g-mole	18.570	18.570	18.570	18.570	18.570	18.510
Enthalpy Kcal/NCM						
HHV Kcal/NCM	2129.864	2129.864	2129.864	2129.864	2129.864	3363.783
LHV Kcal/NCM	1864.858	1864.858	1864.858	1864.858	1864.858	2999.299
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 5 of 46
	MMTE Document No.:	KGMPG00P1100		

	Feed gas from 1st stage preheat outlet	FEED GAS TO REFORMER	REFORMED GAS	REFORMED GAS TO REFORMED GAS MIXER	REFORMED GAS COOLER FEED	REFORMED GAS COOLER DISCHARGE
Stream Name	116	118	119	123	124	125
Flow rate(NCMH) for 250 tph	292,671	292,671	393,377	393,377	0	0
Temperature, C	340	565	940	940	940	36
Pressure, Bar G	1.94	1.866	1.533	1.486	1.533	1.496
Max Flow Rate, NCMH	316,773	316,773	425,928	425,928	71,459	68,800
Max Temperature, C	400	600	1,000	1,000	1,000	40
Max Pressure, Bar G	2.433	2.433	2.033	2.033	2.033	2.033
Composition						
CO	18.32	18.32	34.13	34.13	34.13	35.20
CO2	13.64	13.64	2.45	2.45	2.45	2.53
H2	32.23	32.23	53.47	53.47	53.47	55.15
H2O	14.28	14.28	5.53	5.53	5.53	2.56
N2	3.91	3.91	2.91	2.91	2.91	3.00
CH4	16.67	16.67	1.51	1.51	1.51	1.56
C2H6	0.53	0.53	0.00	0.00	0.00	0.00
C3H8	0.22	0.22	0.00	0.00	0.00	0.00
C4H10	0.12	0.12	0.00	0.00	0.00	0.00
C5+	0.08	0.08	0.00	0.00	0.00	0.00
O2	0.00	0.00	0.00	0.00	0.00	0.00
S.G (@AIR)	0.641	0.641	0.477	0.477	0.477	0.472
Molecular Weight g/g-mole	18.510	18.510	13.770	13.770	13.770	13.640
Enthalpy Kcal/NCM						
HHV Kcal/NCM	3363.783	3363.783	2809.709	2809.709	2809.709	2796.581
LHV Kcal/NCM	2999.299	2999.299	2538.463	2538.463	2538.463	2538.768
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 6 Of 46
	MMTE Document No.:	KGMPG00P1100		

	ENRICHED REFORMED GAS COOLER DISCHARGE	BUSTLE GAS	COOLING GAS OFFTAKES	Cooling Gas From Cooling Gas Scrubber	Cooling Gas From Cooling Gas compressor	Cooling Gas From Cooling Gas Dampener
Stream Name	126	127	130	131	133	134
Flow rate(NCMH) for 250 tph	7,000	410,216.81	167,282	184,258.78	191,709	185,142.27
Temperature, C	25	944	415	37	42.00	41.9
Pressure, Bar G	1.692	1.486	1.486	1.383	1.666	1.65
Max Flow Rate, NCMH	85,271	445,194	200,765	192,000	194,000	194,000
Max Temperature, C	40	970	520	50	55	55
Max Pressure, Bar G	2.033	2.037	1.989	1.961	2.161	2.161
Composition						
CO	0.00	32.78	2.45	2.46	2.36	2.44
CO2	0.33	2.66	1.26	1.26	1.21	1.26
H2	0.00	51.84	30.67	30.75	29.56	30.61
H2O	0.00	5.77	3.10	2.84	6.61	3.30
N2	6.00	3.19	16.30	16.34	15.71	16.27
CH4	88.02	3.77	46.22	46.35	42.55	46.13
C2H6	3.20	0.00	0.00	0.00	0.00	0.00
C3H8	1.30	0.00	0.00	0.00	0.00	0.00
C4H10	0.69	0.00	0.00	0.00	0.00	0.00
C5+	0.46	0.00	0.00	0.00	0.00	0.00
O2	0.00	0.00	0.00	0.00	0.00	0.00
S.G (@AIR)	0.631	0.482	0.499	0.498	0.503	0.499
Molecular Weight g/g-mole	18.220	13.930	14.400	14.390	14.530	14.410
Enthalpy Kcal/NCM						
HHV Kcal/NCM	9523.000	2934.189	5371.522	5384.843	5193.110	5362.459
LHV Kcal/NCM	8661.740	2649.510	4822.770	4836.098	4648.815	4809.260
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE			Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 7 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Cooling Gas Recycle	Cooling Zone Bleed	Cooling Gas After Recycle	Cooling Gas To Mist Eliminator	Cooling Gas To Furnace	Top Gas Fuel From Scrubber To Mixer
Stream Name	135	136	138	139	140	141
Flow rate(NCMH) for 250 tph	17,518	7,500	160,124	163,624	163,624	129,690.39
Temperature, C	41.90	41.9	41.9	41.49	41.47	39
Pressure, Bar G	1.65	1.65	1.65	1.65	1.636	0.234
Max Flow Rate, NCMH	229,305	14,118	184,660	198,778	198,778	142,796
Max Temperature, C	55	55	55	55	55	60
Max Pressure, Bar G	2.161	2.161	2.161	2.161	2.161	0.588
Composition						
CO	2.44	2.44	2.44	2.39	2.39	24.81
CO2	1.26	1.26	1.26	1.24	1.24	18.40
H2	30.61	30.61	30.61	29.95	29.95	43.64
H2O	3.30	3.30	3.30	3.23	3.23	6.55
N2	16.27	16.27	16.27	16.05	16.05	3.94
CH4	46.13	46.13	46.13	47.02	47.02	2.68
C2H6	0.00	0.00	0.00	0.07	0.07	0.00
C3H8	0.00	0.00	0.00	0.03	0.03	0.00
C4H10	0.00	0.00	0.00	0.01	0.01	0.00
C5+	0.00	0.00	0.00	0.01	0.01	0.00
O2	0.00	0.00	0.00	0.00	0.00	0.00
S.G (@AIR)	0.499	0.499	0.499	0.502	0.502	0.646
Molecular Weight g/g-mole	14.410	14.410	14.410	14.490	14.490	18.640
Enthalpy Kcal/NCM						
HHV Kcal/NCM	5362.459	5362.459	5362.459	5452.215	5452.215	2346.366
LHV Kcal/NCM	4809.260	4809.260	4809.260	4894.501	4894.501	2103.654
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 8 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Export Fuel To cold Flare	Top Gas fuel To Fuel Gas Mixer	Top Gas fuel To Mist Eleminator		Top Gas Fuel To Main Burners	Total Flue Gas To Heat Recover System
Stream Name	142	143	144		146	201
Flow rate(NCMH) for 250 tph	7,250	122,440	125,640		125,640	380,416
Temperature, C	39	39.00	38.50		38.5	1125
Pressure, Bar G	0.234	0.109	0.089		0.019	-0.002
Max Flow Rate, NCMH	70,000	142,796	155,058		155,058	448,233
Max Temperature, C	60	60	60		60	1150
Max Pressure, Bar G	0.588	0.588	0.588		0.588	0.005
Composition						
CO	24.81	24.81	24.17		24.17	0.00
CO2	18.40	18.40	17.94		17.94	15.23
H2	43.64	43.64	42.53		42.53	0.00
H2O	6.55	6.55	6.38		6.38	23.41
N2	3.94	3.94	3.99		3.99	60.06
CH4	2.68	2.68	4.85		4.85	0.00
C2H6	0.00	0.00	0.08		0.08	0.00
C3H8	0.00	0.00	0.03		0.03	0.00
C4H10	0.00	0.00	0.02		0.02	0.00
C5+	0.00	0.00	0.01		0.01	0.00
O2	0.00	0.00	0.00		0.00	1.30
S.G (@AIR)	0.646	0.646	0.645		0.645	0.976
Molecular Weight g/g-mole	18.640	18.640	18.630		18.630	28.160
Enthalpy Kcal/NCM						
HHV Kcal/NCM	2346.366	2346.366	2529.409		2529.409	102.384
LHV Kcal/NCM	2103.654	2103.654	227.623		2270.623	0.000
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 9 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Flue Gas & Air To	Flue Gas To	Flue Gas&Air To	Flue Gas OUT OF	Flue Gas out of	Exhaust Gas From
	Heat Recovery System	Heat Recovery (Each)	Heat Recovery (Each)	Heat Recovery (Each)	Heat Recovery System	Ejector Stack
Stream Name	202	203	204	207	208	209
Flow rate(NCMH) for 250 tph	380,416	190,208	190,208	190,208	380,416	958,345
Temperature, C	1125.0	1125.0	1125.0	320.3	320.3	156.2
Pressure, Bar G	-0.002	-0.002	-0.002	-0.006	-0.006	0.00
Max Flow Rate, NCMH	448,233	224,116	224,116	224,116	448,233	1,080,576
Max Temperature, C	1,150	1,150	1,150	530	530	244
Max Pressure, Bar G	0.005	0.005	0.005	0.005	0.005	0.000
Composition						
CO	0.00	0.00	0.00	0.00	0.00	0.00
CO2	15.23	15.23	15.23	15.23	15.23	6.05
H2	0.00	0.00	0.00	0.00	0.00	0.00
H2O	23.41	23.41	23.41	23.41	23.41	12.53
N2	60.06	60.06	60.06	60.06	60.06	68.92
CH4	0.00	0.00	0.00	0.00	0.00	0.00
C2H6	0.00	0.00	0.00	0.00	0.00	0.00
C3H8	0.00	0.00	0.00	0.00	0.00	0.00
C4H10	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
O2	1.30	1.30	1.30	1.30	1.30	12.50
S.G (@AIR)	0.976	0.976	0.976	0.976	0.976	0.978
Molecular Weight g/g-mole	28.160	28.170	28.170	28.170	28.170	28.230
Enthalpy Kcal/NCM						
HHV Kcal/NCM	102.384	102.384	102.384	102.384	102.384	54.791
LHV Kcal/NCM	0.000	0.000	0.000	0.000	0.000	0.000
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 10 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Flue Gas To Seal Gas System	Flue Gas To Seal Gas Cooler	Seal Gas Cooler Discharge	Seal Gas Compressor Discharge	Seal Gas Compressor Recycle	Seal Gas After Cooler Discharge
Stream Name	220	221	222	224	225	227
Flow rate(NCMH) for 250 tph	16,973	16,973	15,010	15,010	1,071	13,375
Temperature, C	1125	1125	34	194.3	41	41
Pressure, Bar G	-0.002	-0.002	-0.011	2.09	2.0	2.0
Max Flow Rate, NCMH	26,869	26,869	22,000	22,000	22,000	22,000
Max Temperature, C	1,150	1,150	40	200	43	43
Max Pressure, Bar G	0.00	0.00	0.00	2.4	2.2	2.2
Composition						
CO	0.00	0.00	0.00	0.00	0.00	0.00
CO2	15.23	15.23	18.60	18.60	18.60	19.33
H2	0.00	0.00	0.00	0.00	0.00	0.00
H2O	23.41	23.41	6.46	6.46	6.46	2.81
N2	60.06	60.06	73.35	73.35	73.35	76.21
CH4	0.00	0.00	0.00	0.00	0.00	0.00
C2H6	0.00	0.00	0.00	0.00	0.00	0.00
C3H8	0.00	0.00	0.00	0.00	0.00	0.00
C4H10	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
O2	1.30	1.30	1.59	1.59	1.59	1.65
S.G (@AIR)	0.976	0.976	1.054	1.054	1.054	1.070
Molecular Weight g/g-mole	28.160	28.160	30.410	30.410	30.410	30.890
Enthalpy Kcal/NCM						
HHV Kcal/NCM	102.384	102.384	28.252	28.252	28.252	12.294
LHV Kcal/NCM	0.000	0.000	0.000	0.000	0.000	0.000
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 11 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Wet Seal Gas To users	Wet Seal Gas From Bot.seal Mist Eliminator	Wet Seal Gas to BSG Bubbler	Wet Seal Gas to Upper Seal Gas Inlet Cone	Wet Seal Gas to Furnace Pressurizing	
Stream Name	228	231	232	233	234	
Flow rate(NCMH) for 250 tph	7,429	4,800	0	2,629	0	
Temperature, C	41	41	41	41	41	
Pressure, Bar G	2.0	1.96	0.00	0.391	0.375	
Max Flow Rate, NCMH	9,465	5,760	59	3,681	(5882)	
Max Temperature, C	43	43	43	43	43	
Max Pressure, Bar G	2.2	2.2	0.00	0.588	0.588	
Composition						
CO	0.00	0.00	0.00	0.00	0.00	
CO2	19.33	19.33	19.33	19.33	19.33	
H2	0.00	0.00	0.00	0.00	0.00	
H2O	2.81	2.81	2.81	2.81	2.81	
N2	76.21	76.21	76.21	76.21	76.21	
CH4	0.00	0.00	0.00	0.00	0.00	
C2H6	0.00	0.00	0.00	0.00	0.00	
C3H8	0.00	0.00	0.00	0.00	0.00	
C4H10	0.00	0.00	0.00	0.00	0.00	
C5+	0.00	0.00	0.00	0.00	0.00	
O2	1.65	1.65	1.65	1.65	1.65	
S.G (@AIR)	1.07	1.07	1.07	1.07	1.07	
Molecular Weight g/g-mole	30.89	30.89	30.89	30.89	30.89	
Enthalpy Kcal/NCM						
HHV Kcal/NCM	12.294	12.294	12.294	12.294	12.294	
LHV Kcal/NCM	0.000	0.000	0.000	0.000	0.000	
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 12 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Wet Seal Gas To Seal Gas Dryer	Dry Seal Gas From Seal Gas Dryer	Dry Seal Gas to Lower Seal Leg Inlet Cone	Dry Seal Gas to Bubbler	Dry Seal Gas to Grating Feeder	Dry Seal Gas to PDC Tramp Material Discharge
Stream Name	239	240	241	242	243	244
Flow rate(NCMH) for 250 tph	5,946.38	5,797.81	928	0	168	0
Temperature, C	41	5	5	5.00	5.00	5.00
Pressure, Bar G	2.0	1.92	1.579	1.92	1.92	1.92
Max Flow Rate, NCMH	7,590	7,400	1,047	59	194	176
Max Temperature, C	48	15	15	15	15	15
Max Pressure, Bar G	2.2	2.2	2.2	2.2	2.2	2.2
Composition						
CO	0.00	0.00	0.00	0.00	0.00	0.00
CO2	19.33	19.82	19.82	19.82	19.82	19.82
H2	0.00	0.00	0.00	0.00	0.00	0.00
H2O	2.81	0.32	0.32	0.32	0.32	0.32
N2	76.21	78.16	78.16	78.16	78.16	78.16
CH4	0.00	0.00	0.00	0.00	0.00	0.00
C2H6	0.00	0.00	0.00	0.00	0.00	0.00
C3H8	0.00	0.00	0.00	0.00	0.00	0.00
C4H10	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
O2	1.65	1.69	1.69	1.69	1.69	1.69
S.G (@AIR)	1.07	1.082	1.082	1.082	1.082	1.082
Molecular Weight g/g-mole	30.89	31.220	31.220	31.220	31.220	31.220
Enthalpy Kcal/NCM						
HHV Kcal/NCM	12.294	1.414	1.414	1.414	1.414	1.414
LHV Kcal/NCM	0.000	0.000	0.000	0.000	0.000	0.000
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 13 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Dry Seal Gas to HDRI Inlet Cone	Dry Seal Gas to PDC		Dry Seal Gas to Tranzition Zone	Dry Seal Gas to Purge Gas Compressor	Dry Seal Gas from Purge Gas Compressor
Stream Name	245	246		248	249	250
Flow rate(NCMH) for 250 tph	2,932	0		0	122.81	122.81
Temperature, C	5	5		5	5	38
Pressure, Bar G	1.579	1.579		1.92	1.92	14.2
Max Flow Rate, NCMH	3,245	118		386	800	800
Max Temperature, C	15	15		15	15	45
Max Pressure, Bar G	2.2	2.2		2.2	2.2	15.4
Composition						
CO	0.00	0.00		0.00	0.00	0.00
CO2	19.82	19.82		19.82	19.82	19.82
H2	0.00	0.00		0.00	0.00	0.00
H2O	0.32	0.32		0.32	0.32	0.32
N2	78.16	78.16		78.16	78.16	78.16
CH4	0.00	0.00		0.00	0.00	0.00
C2H6	0.00	0.00		0.00	0.00	0.00
C3H8	0.00	0.00		0.00	0.00	0.00
C4H10	0.00	0.00		0.00	0.00	0.00
C5+	0.00	0.00		0.00	0.00	0.00
O2	1.69	1.69		1.69	1.69	1.69
S.G (@AIR)	1.082	1.082		1.082	1.082	1.082
Molecular Weight g/g-mole	31.220	31.220		31.220	31.220	31.220
Enthalpy Kcal/NCM						
HHV Kcal/NCM	1.414	1.414		1.414	1.414	1.414
LHV Kcal/NCM	0.000	0.000		0.000	0.000	0.000
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 14 Of 46
	MMTE Document No.:	KGMPG00P1100		

		Purge Gas after Purge Gas Dryer	Purge gas to dry seal gas users	Purge gas to impulse distribution	Purge gas to purge distribution	Inert gas generator discharge
Stream Name		252	254	260	261	298
Flow rate(NCMH) for 250 tph		122.41	0	118	0	0
Temperature, C		38	38	38	38	38.00
Pressure, Bar G		14.0	1.92	4	0.469	0.656
Max Flow Rate, NCMH		800	1,765	120	680	3,000
Max Temperature, C		45	45	45	45	45
Max Pressure, Bar G		15.4	2.2	4.0	1.2	1.0
Composition						
CO		0.00	0.00	0.00	0.00	0.00
CO2		19.88	19.88	19.88	19.88	18.83
H2		0.00	0.00	0.00	0.00	0.00
H2O		0.00	0.00	0.00	0.00	3.88
N2		78.42	78.42	78.42	78.42	75.53
CH4		0.00	0.00	0.00	0.00	0.00
C2H6		0.00	0.00	0.00	0.00	0.00
C3H8		0.00	0.00	0.00	0.00	0.00
C4H10		0.00	0.00	0.00	0.00	0.00
C5+		0.00	0.00	0.00	0.00	0.00
O2		1.70	1.70	1.70	1.70	1.81
S.G (@AIR)		1.083	1.083	1.083	1.083	0.77
Molecular Weight g/g-mole		31.26	31.26	31.26	31.26	22.146
Enthalpy Kcal/NCM						
HHV Kcal/NCM		0.000	0.000	0.000	0.000	7693.633
LHV Kcal/NCM		0.000	0.000	0.000	0.000	6982.037
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 15 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Total Natural Gas to The Plant	Natural Gas to Process Natural Gas preheaters	Natural gas from preheat	Natural Gas to Top Gas Fuel Mixer	Natural Gas to Auxiliary Burner	
Stream Name	306	307	309	310	311	
Flow rate(NCMH) for 250 tph	67,289	48,852	48,852	3,200	987	
Temperature, C	25	25.00	370	25	25	
Pressure, Bar G	4	2.06	2	0.255	0.088	
Max Flow Rate, NCMH	75,000	52,875	52,875	10,422	4,421	
Max Temperature, C	35	35	400	35	35	
Max Pressure, Bar G	6	3.1	3.03	0.588	0.16	
Composition						
CO	0.00	0.00	0.00	0.00	0.00	
CO2	0.33	0.33	0.33	0.33	0.33	
H2	0.00	0.00	0.00	0.00	0.00	
H2O	0.00	0.00	0.00	0.00	0.00	
N2	6.00	6.00	6.00	6.00	6.00	
CH4	88.02	88.02	88.02	88.02	88.02	
C2H6	3.20	3.20	3.20	3.20	3.20	
C3H8	1.30	1.30	1.30	1.30	1.30	
C4H10	0.69	0.69	0.69	0.69	0.69	
C5+	0.46	0.46	0.46	0.46	0.46	
O2	0.00	0.00	0.00	0.00	0.00	
S.G (@AIR)	0.631	0.631	0.631	0.631	0.631	
Molecular Weight g/g-mole	18.220	18.220	18.220	18.220	18.220	
Enthalpy Kcal/NCM						
HHV Kcal/NCM	9523	9523	9523	9523	9523	
LHV Kcal/NCM	8661.740	8661.740	8661.740	8661.740	8661.740	
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 16 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Natural Gas to Enrichment	Natural Gas To Furnace Transition zone	Natural Gas to Cooling Gas Mist Eliminator	Natural Gas to Flue Gas After Burner	Natural Gas to Inert Gas Generator	Natural Gas to Furnace Lower Cone
Stream Name	312	313	314	315	316	317
Flow rate(NCMH) for 250 tph	7,000	3,751	3,500	0	0	0
Temperature, C	25	25	25	25	25	25
Pressure, Bar G	1.7	1.488	1.655	0.03	2.06	1.655
Max Flow Rate, NCMH	16,471	7,368	14,118	1,046	400	400
Max Temperature, C	35	35	35	35	35	35
Max Pressure, Bar G	3.1	3.1	3.1	0.075	3.10	3.10
Composition						
CO	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.33	0.33	0.33	0.33	0.33	0.33
H2	0.00	0.00	0.00	0.00	0.00	0.00
H2O	0.00	0.00	0.00	0.00	0.00	0.00
N2	6.00	6.00	6.00	6.00	6.00	6.00
CH4	88.02	88.02	88.02	88.02	88.02	88.02
C2H6	3.20	3.20	3.20	3.20	3.20	3.20
C3H8	1.30	1.30	1.30	1.30	1.30	1.30
C4H10	0.69	0.69	0.69	0.69	0.69	0.69
C5+	0.46	0.46	0.46	0.46	0.46	0.46
O2	0.00	0.00	0.00	0.00	0.00	0.00
S.G (@AIR)	0.631	0.631	0.631	0.631	0.631	0.631
Molecular Weight g/g-mole	18.220	18.220	18.220	18.220	18.220	18.220
Enthalpy Kcal/NCM						
HHV Kcal/NCM	9523	9523	9523	9523	9523	9523
LHV Kcal/NCM	8661.740	8661.740	8661.740	8661.740	8661.740	8661.740
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 17 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Natural Gas to Product Cooler	Air To Main Air Blower	Main Air Blower Discharge	Main Air to Air Preheater (1st Preheat)	Main Air to Air Preheater (2nd Preheat)	Main Air To Main Burner
Stream Name	318	400	402	403	404	405
Flow rate(NCMH) for 250 tph	0	323,827	323,827	323,827	323,827	323,827
Temperature, C	25	40	63.67	63.64	300	675
Pressure, Bar G	1.655	0.00	0.18	0.11	0.095	0.055
Max Flow Rate, NCMH	941	380,000	380,000	380,000	380,000	380,000
Max Temperature, C	35	50	69	69	310	700
Max Pressure, Bar G	3.10	0.000	0.235	0.165	0.12	0.060
Composition						
CO	0.00	0.00	0.00	0.00	0.00	0.00
CO2	0.33	0.00	0.00	0.00	0.00	0.00
H2	0.00	0.00	0.00	0.00	0.00	0.00
H2O	0.00	5.37	5.37	5.37	5.37	5.37
N2	6.00	74.76	74.76	74.76	74.76	74.76
CH4	88.02	0.00	0.00	0.00	0.00	0.00
C2H6	3.20	0.00	0.00	0.00	0.00	0.00
C3H8	1.30	0.00	0.00	0.00	0.00	0.00
C4H10	0.69	0.00	0.00	0.00	0.00	0.00
C5+	0.46	0.00	0.00	0.00	0.00	0.00
O2	0.00	19.87	19.87	19.87	19.87	19.87
S.G (@AIR)	0.631	0.979	0.979	0.979	0.979	0.979
Molecular Weight g/g-mole	18.220	28.270	28.270	28.270	28.270	28.270
Enthalpy Kcal/NCM						
HHV Kcal/NCM	9523	23.482	23.482	23.482	23.482	23.482
LHV Kcal/NCM	8661.740	0.000	0.000	0.000	0.000	0.000
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 18 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Dilution air from Main air blower	Main air to aux burners	Air to Auxiliary Air Blower	Auxiliary Air Blower Discharge	Auxiliary Air To Auxiliary Burners	Auxiliary Air To After Burning
Stream Name	406	407	410	411	412	413
Flow rate(NCMH) for 250 tph	0	0	12,460	12,460	12,460	0
Temperature, C	63.67	63.67	40.00	53.57	53.54	53.54
Pressure, Bar G	0.18	0.18	0.00	0.1	0.003	0.03
Max Flow Rate, NCMH	60,000	50,000	50,000	50,000	50,000	3,141
Max Temperature, C	69	69	50	65	55	55
Max Pressure, Bar G	0.235	0.235	0.00	0.12	0.031	0.075
Composition						
CO	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
H2	0.00	0.00	0.00	0.00	0.00	0.00
H2O	5.37	5.37	5.37	5.37	5.37	5.37
N2	74.76	74.76	74.76	74.76	74.76	74.76
CH4	0.00	0.00	0.00	0.00	0.00	0.00
C2H6	0.00	0.00	0.00	0.00	0.00	0.00
C3H8	0.00	0.00	0.00	0.00	0.00	0.00
C4H10	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
O2	19.87	19.87	19.87	19.87	19.87	19.87
S.G (@AIR)	0.979	0.979	0.979	0.979	0.979	0.979
Molecular Weight g/g-mole	28.270	28.270	28.270	28.270	28.270	28.270
Enthalpy Kcal/NCM						
HHV Kcal/NCM	23.482	23.482	23.482	23.482	23.482	23.482
LHV Kcal/NCM	0.000	0.000	0.000	0.000	0.000	0.000
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT			MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 19 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Air To Dilution Air Blower	Dilution Air Blower Discharge	Air to Ejector Stack Fan	Air to Ejector Stack*	Air to Inert gas generator blower	Air to Inert gas generator
Stream Name	420	421	430	431	440	441
Flow rate(NCMH) for 250 tph	0	0	577,929	577,929	0	0
Temperature, C	40.00	53.57	40	47.33	40	48
Pressure, Bar G	0.00	0.1	0.00	0.053	0.00	
Max Flow Rate, NCMH	50,000	50,000	690,000	690,000	3,500	3,500
Max Temperature, C	50	65	50	60	50	55
Max Pressure, Bar G	0.00	0.12	0.00	0.085	0.00	0.06
Composition						
CO	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
H2	0.00	0.00	0.00	0.00	0.00	0.00
H2O	5.37	5.37	5.37	5.37	5.37	5.37
N2	74.76	74.76	74.76	74.76	74.76	74.76
CH4	0.00	0.00	0.00	0.00	0.00	0.00
C2H6	0.00	0.00	0.00	0.00	0.00	0.00
C3H8	0.00	0.00	0.00	0.00	0.00	0.00
C4H10	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
O2	19.87	19.87	19.87	19.87	19.87	19.87
S.G (@AIR)	0.979	0.979	0.979	0.979	0.979	0.979
Molecular Weight g/g-mole	28.270	28.270	28.270	28.270	28.270	28.270
Enthalpy Kcal/NCM						
HHV Kcal/NCM	23.482	23.482	23.482	23.482	23.482	23.482
LHV Kcal/NCM	0.000	0.000	0.000	0.000	0.000	0.000
Heat of Formation Kcal/NCM						

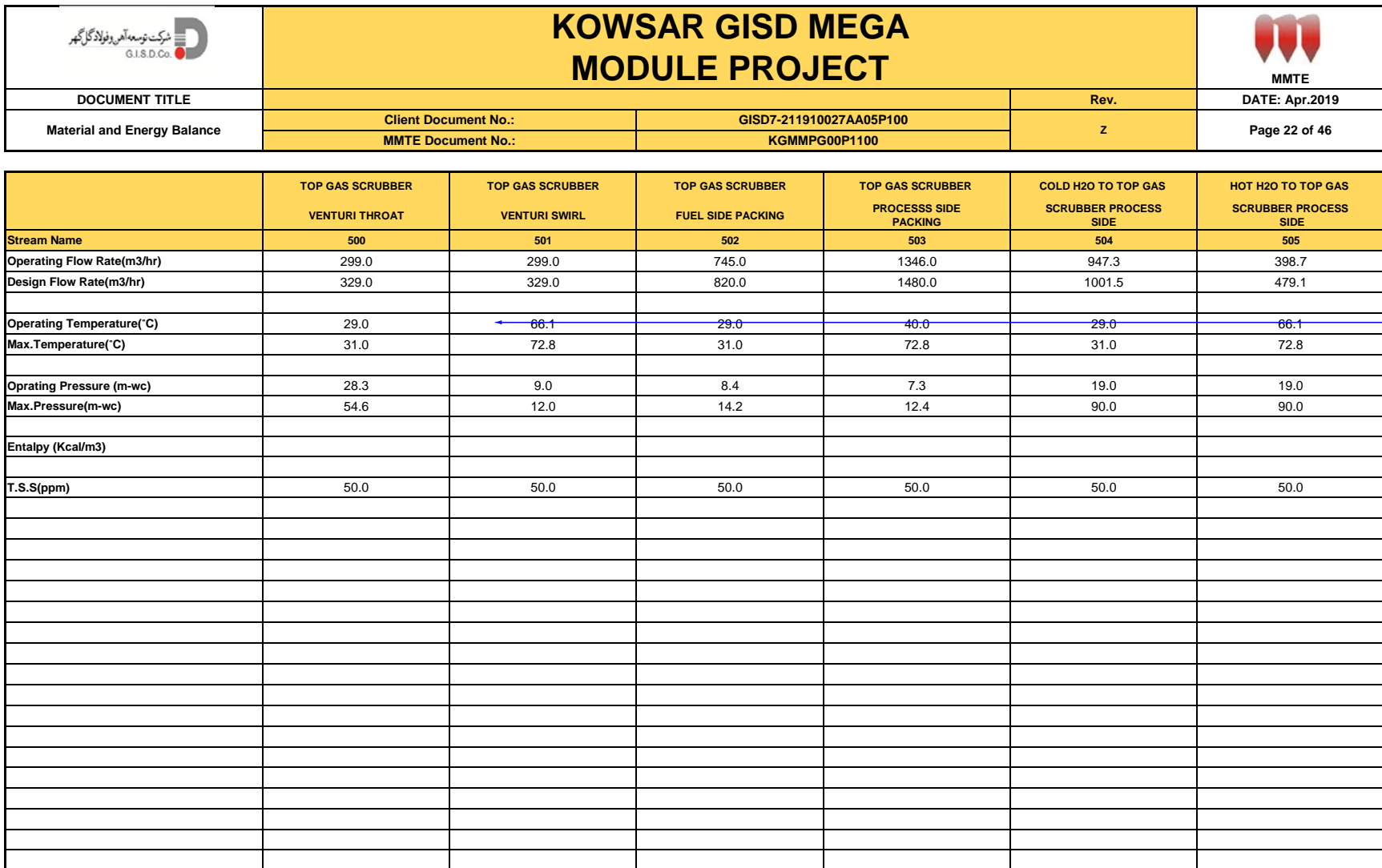
KOWSAR GISD MEGA MEGA MODULE PROJECT

				MMTE
DOCUMENT TITLE	Document No:		Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 20 Of 46
	MMTE Document No.:	KGMPG00P1100		

	Oxygen to bustle line	Feed Gas to Disulphurization unit	Feed Gas From Disulphurization unit			
Stream Name	450	451	452			
Flow rate(NCMH) for 250 tph	2,000	292,671	292,671			
Temperature, C	25	340	320.00			
Pressure, Bar G	1.489	1.94	1.94			
Max Flow Rate, NCMH	5,000	316,773	316,773			
Max Temperature, C	35	400	400			
Max Pressure, Bar G	6	2.43	2.43			
Composition						
CO	0.00	18.32	18.32			
CO2	0.00	13.64	13.64			
H2	0.00	32.23	32.23			
H2O	0.00	14.28	14.28			
N2	0.10	3.91	3.91			
CH4	0.00	16.67	16.67			
C2H6	0.00	0.53	0.53			
C3H8	0.00	0.22	0.22			
C4H10	0.00	0.12	0.12			
C5+	0.00	0.08	0.08			
O2	99.90	0.00	0.00			
H2S(ppm)		20.00				
S.G (@AIR)	1.109	0.641	0.64			
Molecular Weight g/g-mole	32	18.51	18.51			
Enthalpy Kcal/NCM						
HHV Kcal/NCM	0.000	3363.783	3363.783			
LHV Kcal/NCM	0.000	2999.299	2999.299			
Heat of Formation Kcal/NCM						

	KOWSAR GISD MEGA MODULE PROJECT		MMTE
DOCUMENT TITLE	Document No:	Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z
	MMTE Document No.:	KGMMMPG00P1100	

[illegible]





MMTE

DATE: Apr.2019

Page 24 of 46

DOCUMENT TITLE

Rev.

Material and Energy Balance

Client Document No.:

GISD7-211910027AA05P100

Z

MMTE Document No.:

KGMMPG00P1100

[illegible]



DATE: Apr.2019

Page 25 of 46

[illegible]

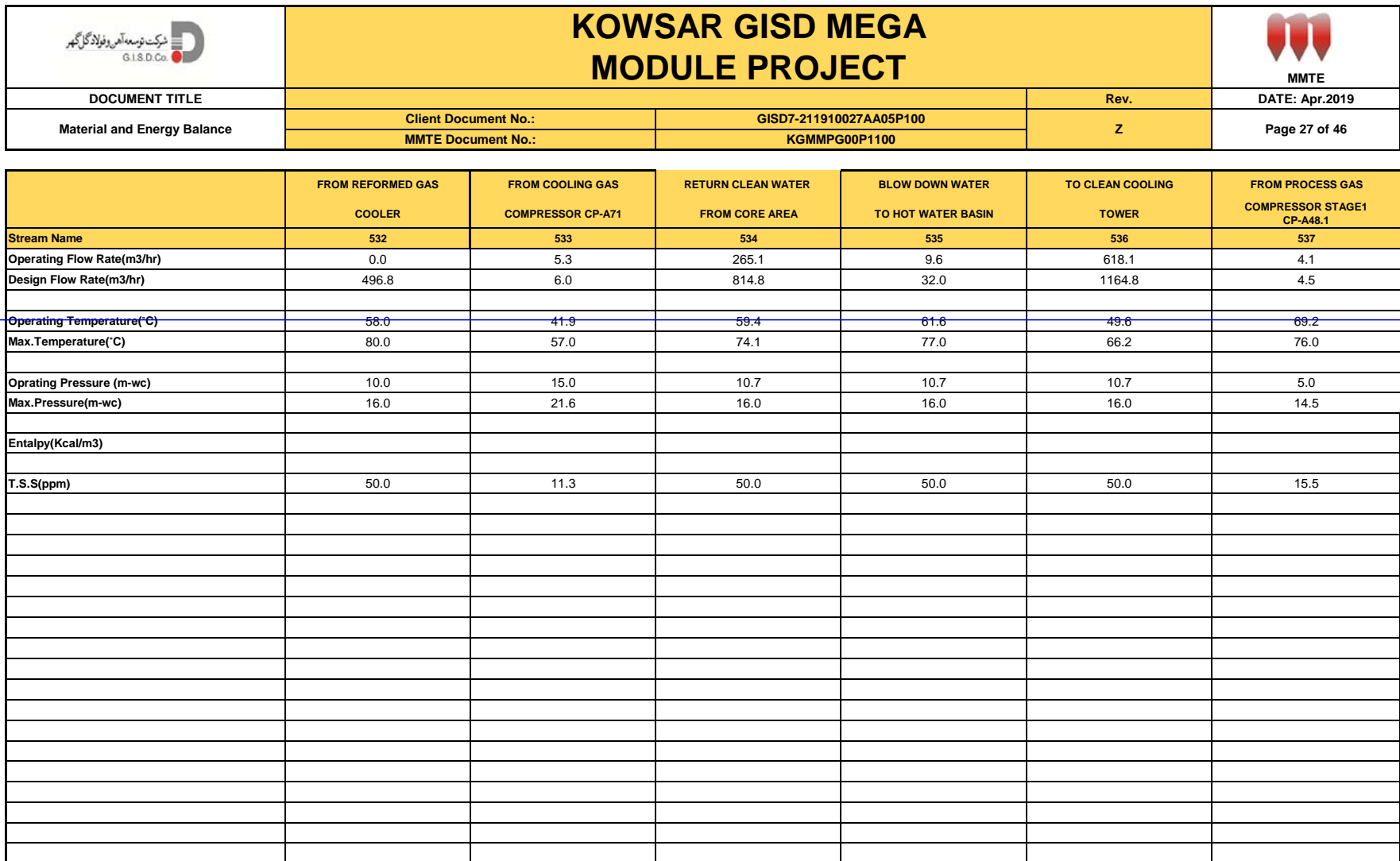


MMTE

DATE: Apr,2019

Page 26 of 46

[illegible]





MMTE

DOCUMENT TITLE

Rev.

DATE: Apr.2019

Material and Energy Balance

Client Document No.:

GISD7-211910027AA05P100

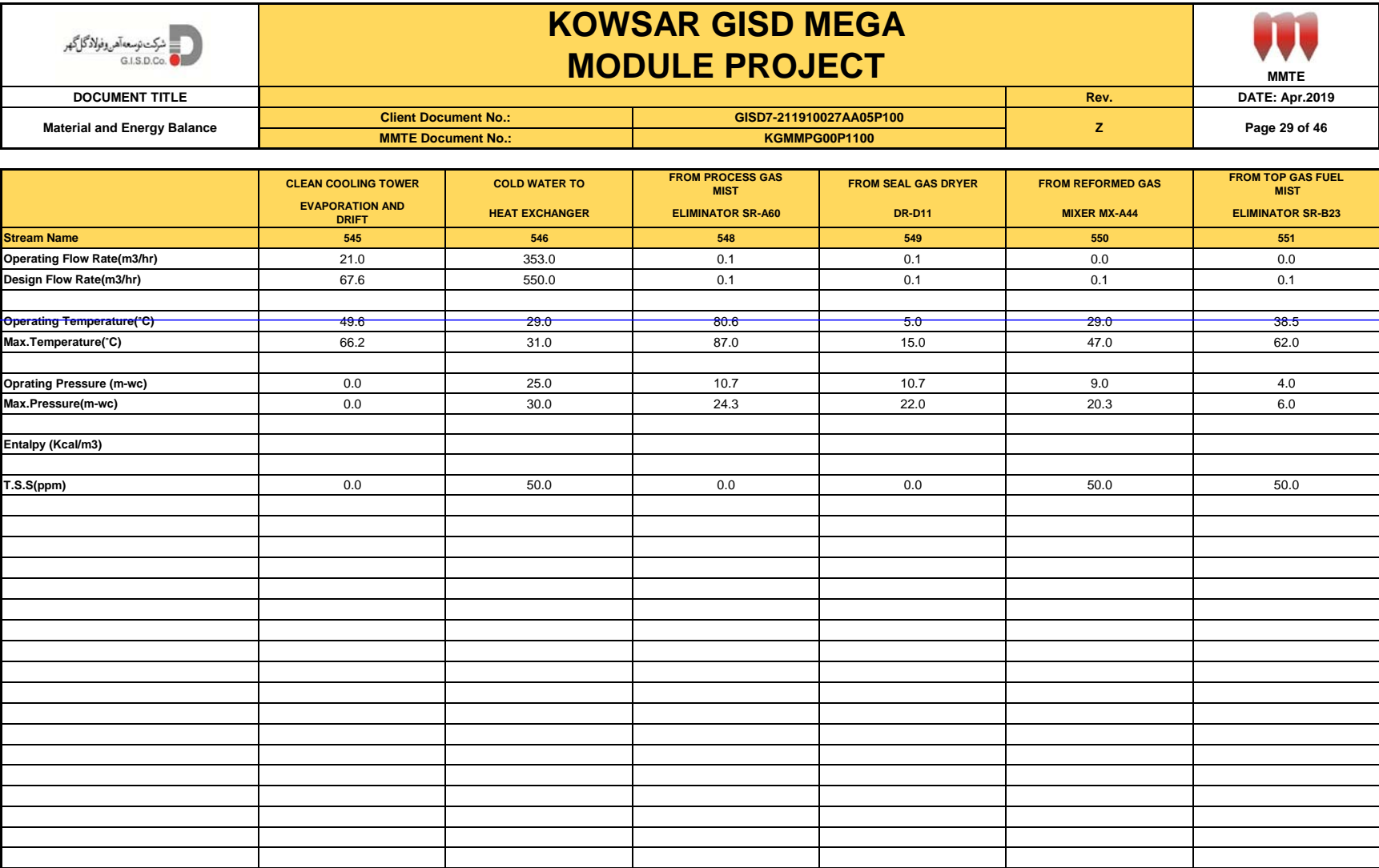
Z

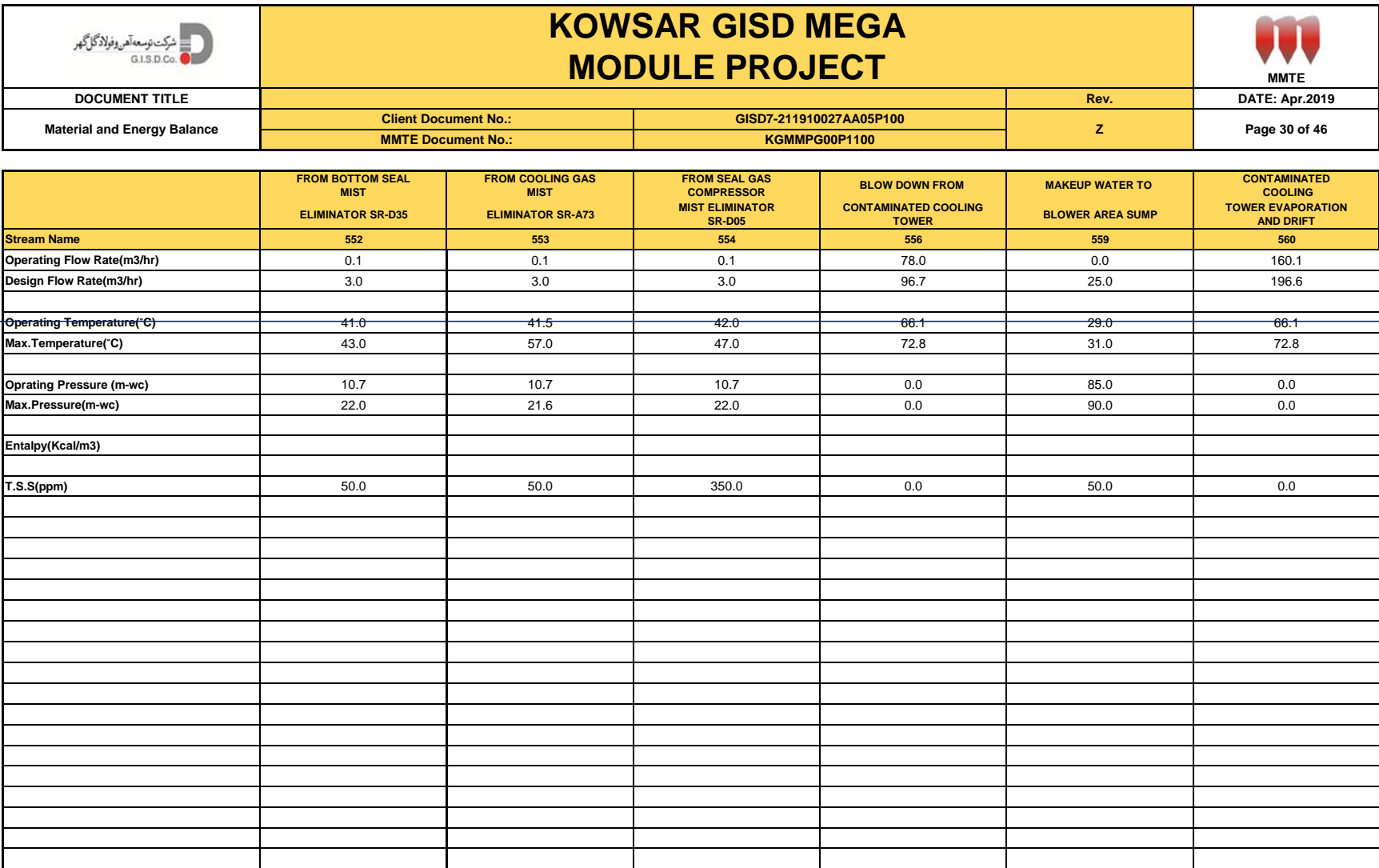
Page 28 of 46

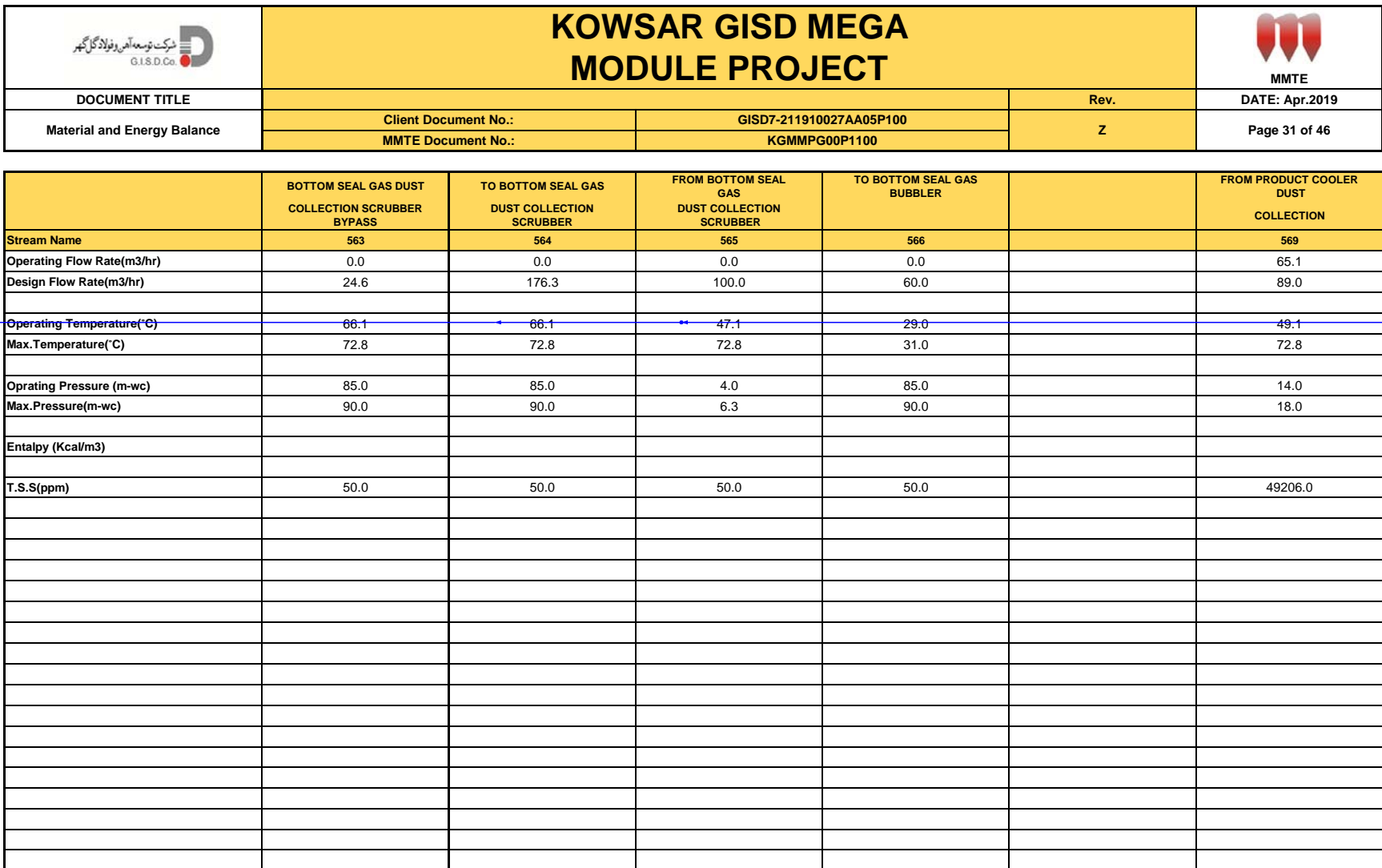
MMTE Document No.:

KGMMPG00P1100

[illegible]









MMTE

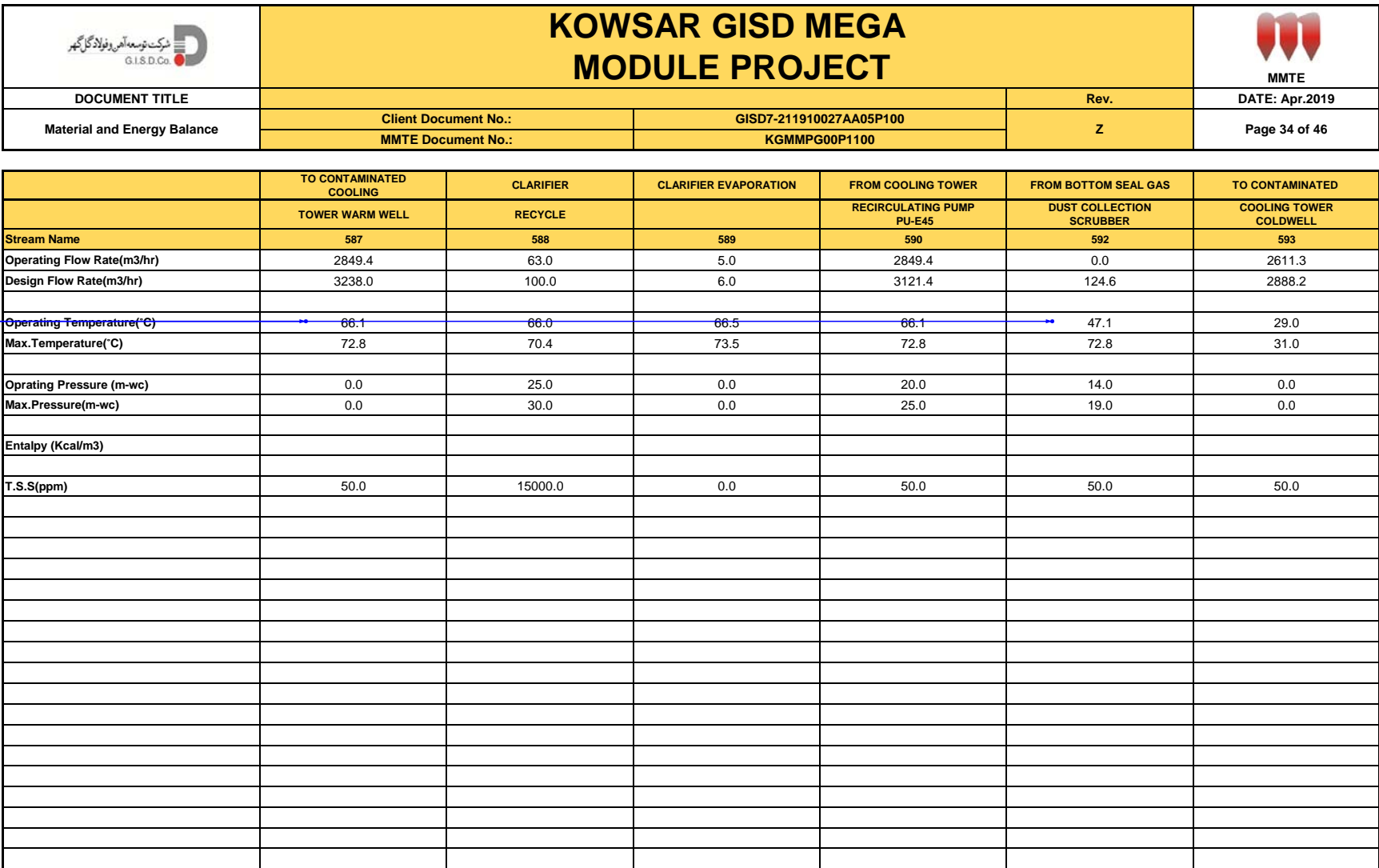
DATE: Apr.2019

Page 32 of 46

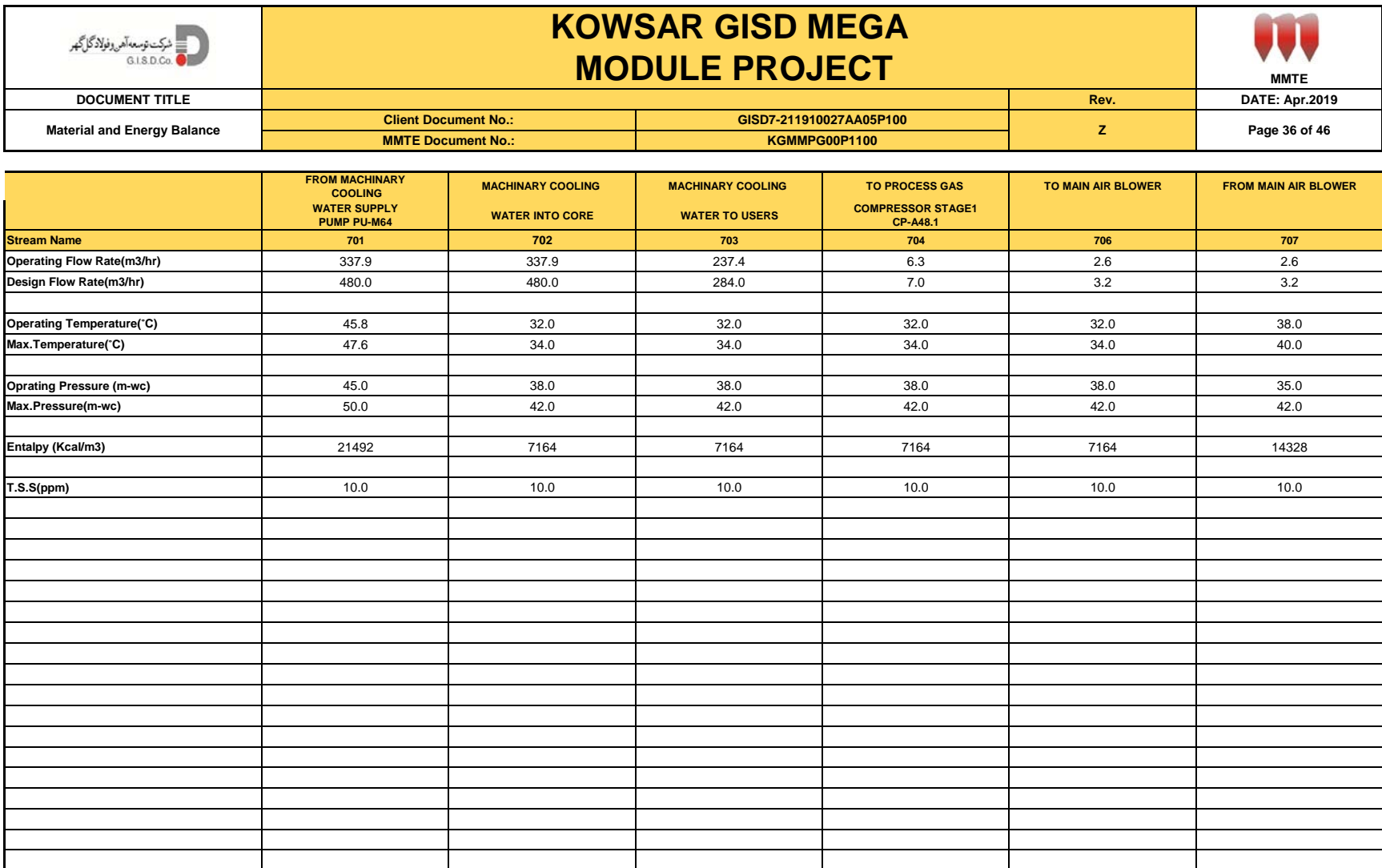
DOCUMENT TITLE			Rev.	DATE: Apr.2019
Material and Energy Balance	Client Document No.:	GISD7-211910027AA05P100	Z	Page 32 of 46
	MMTE Document No.:	KGMMMPG00P1100		

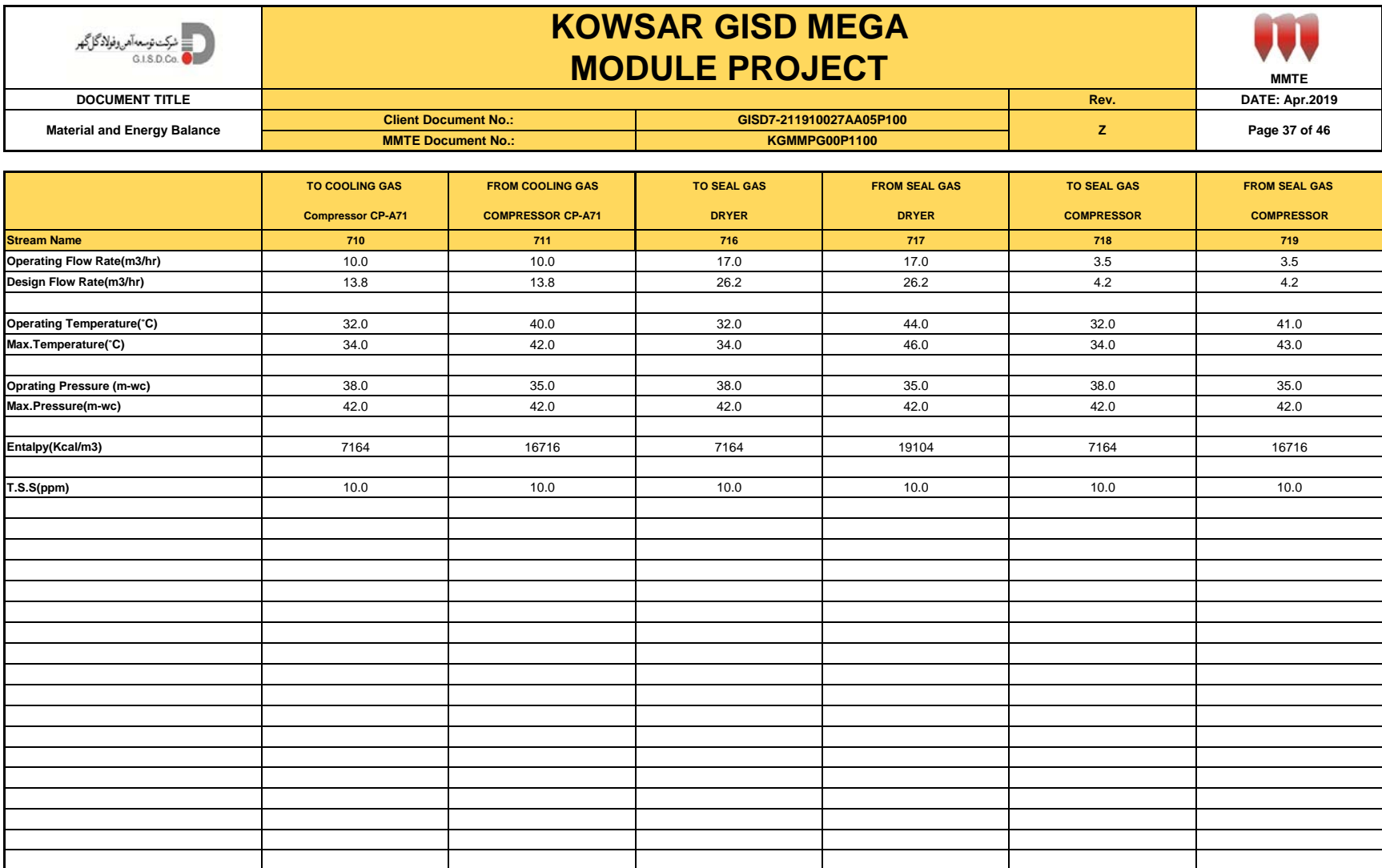
[illegible]

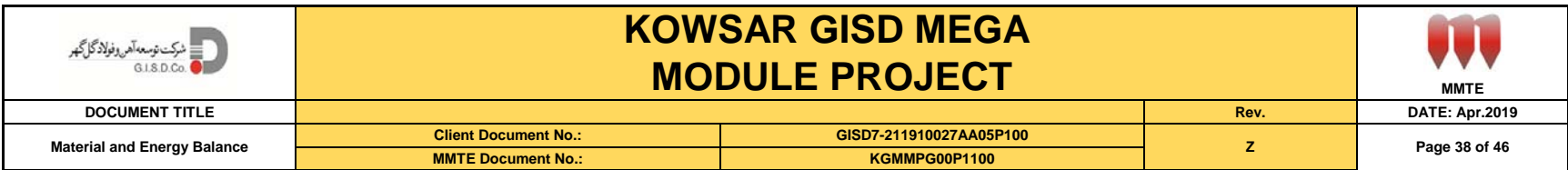
*sludge design quantity is 1711 kg/hr

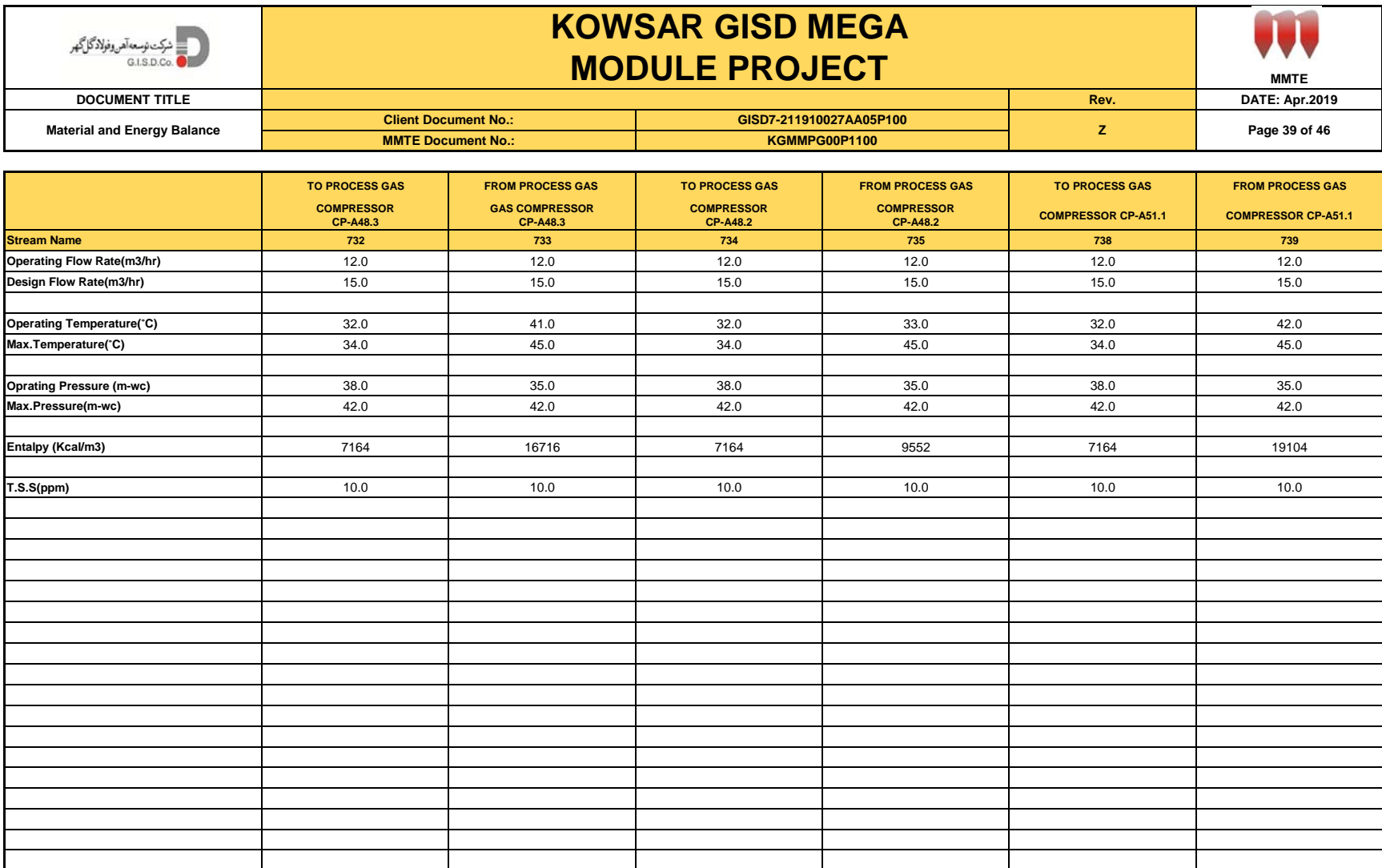


* Sludge design quantity is 14900 kg/ hr





[illegible]





MMTE

DATE: Apr.2019

DOCUMENT TITLE

Rev.

Material and Energy Balance

Client Document No.:

GISD7-211910027AA05P100

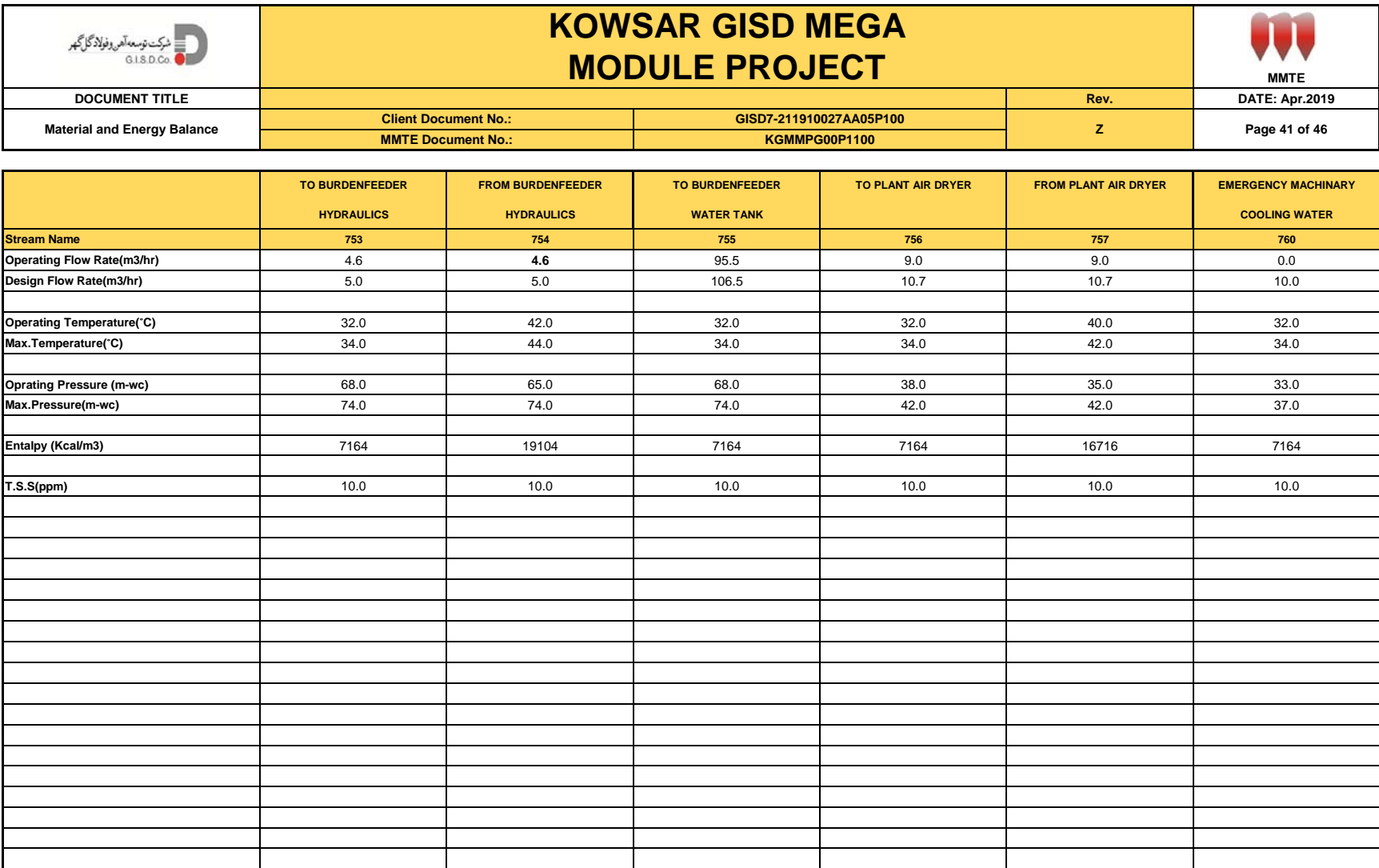
Z

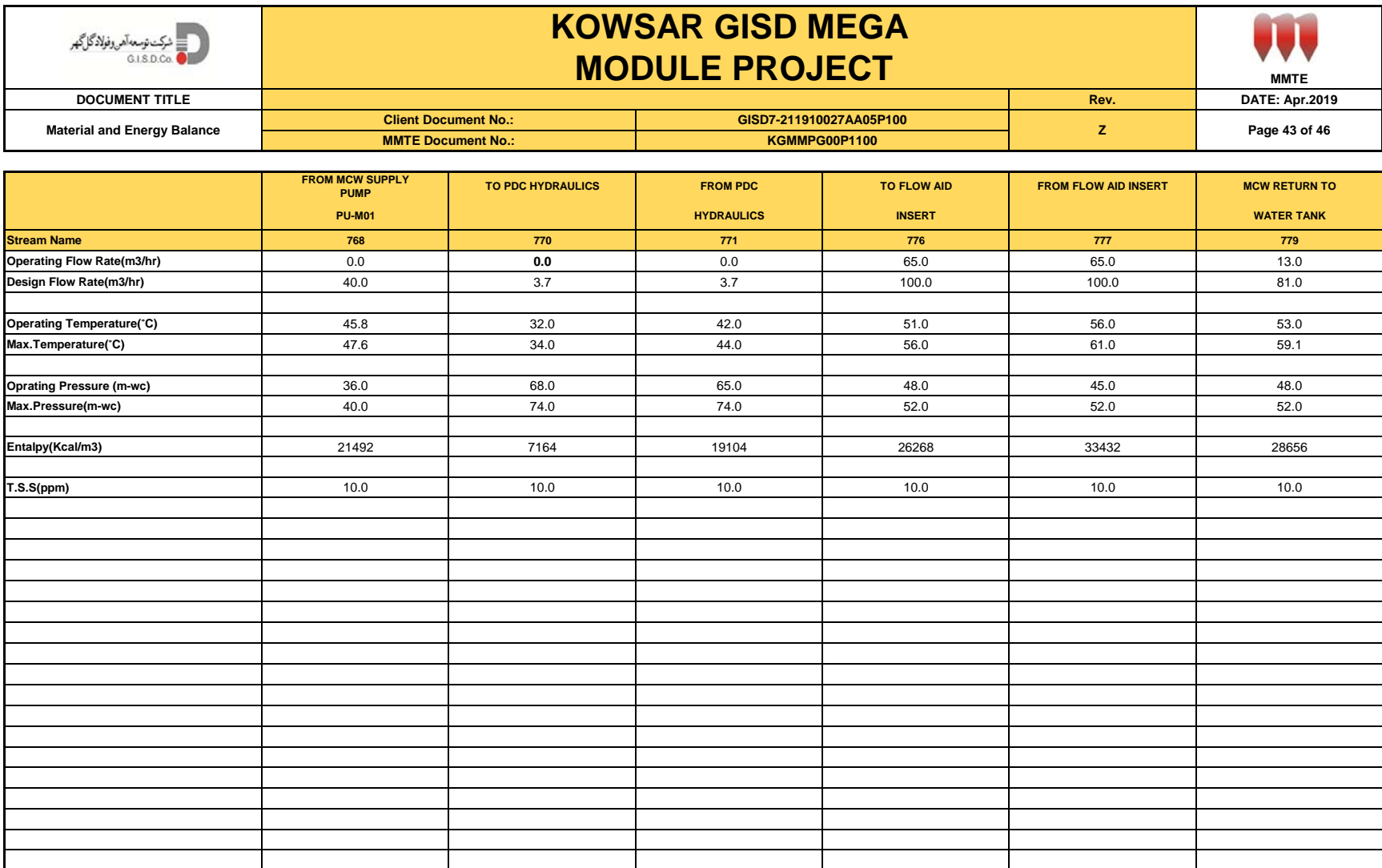
Page 40 of 46

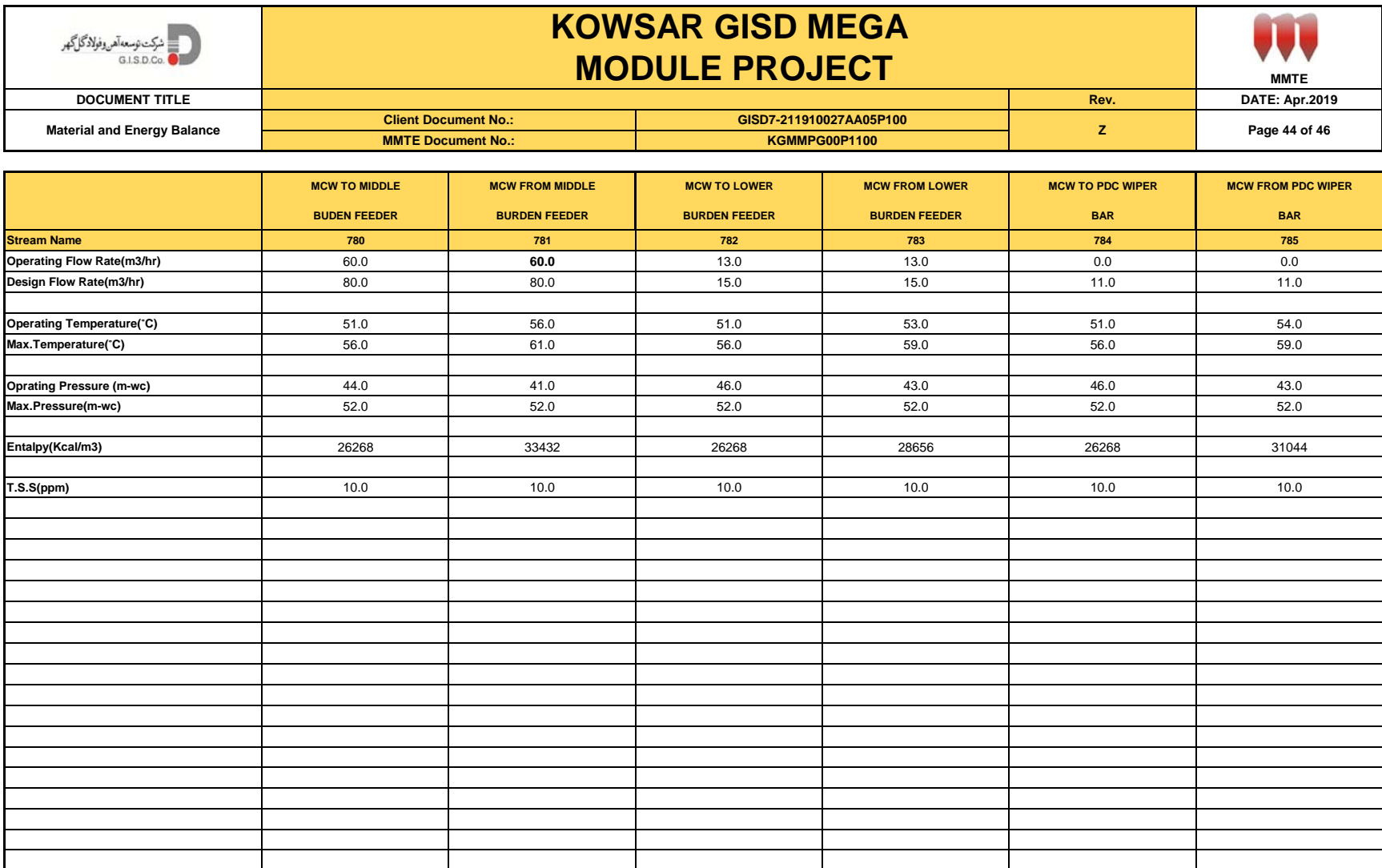
MMTE Document No.:

KGMMPG00P1100

[illegible]









MMTE

DATE: Apr.2019

DOCUMENT TITLE

Rev.

Material and Energy Balance

Client Document No.:

GISD7-211910027AA05P100

Z

Page 45 of 46

MMTE Document No.:

KGMMPG00P1100

[illegible]



MMTE

DATE: Apr.2019

DOCUMENT TITLE

Rev.

Material and Energy Balance

Client Document No.:

GISD7-211910027AA05P100

Z

Page 46 of 46

MMTE Document No.:

KGMMPG00P1100

[illegible]