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APPENDIX A

Calculation of Maximum Hourly, Daily, and **Annual Emissions**

Tables presented in this Appendix are as follows:

A-1A-C	Turbine/Aux Boiler Criteria Pollutant Emissions (including GHGs)
A-2	Turbine HAPs Emissions
A-3	Turbine Startup/Shutdown Emissions
A-4A-C	Auxiliary Boiler HAPs Emissions
A-5	Emergency Generator Criteria and HAPs Emissions (including GHGs)
A-6	Fire-pump Criteria and HAPs Emissions (including GHGs)
A-7	Natural Gas Analysis Data
A-8	Typical ULSFO Analysis
A-9	Commissioning Emissions Estimates
A-10	Fuel Use Calculations for Turbines/duct burners

In addition to the above tables, other miscellaneous support data for the device-specific emissions calculations is also included in this Appendix.

Attachment	A-1	Turbine Run Scenario Specification Sheets
Attachment	A-2	Fire Pump and Gen Set Engine Specification Sheets
Attachment	A-3	Auxiliary Boiler Specification Sheets

Table A-1A

Maximum Hourly, Daily, and Annual Emissions Calculations

Number of Identical Engines: 2

Case #: Ops Scenario 1 - Cold Day and ISO Cases — Turbine Model: SCC6-5000F

Input data per unit:

	Max Operation hrs/day	Max Annual Op hrs	Avg # of Cold Startups day	Avg # of Warm Startups day	Avg # of Hot Startups day	Cold Startup Time hrs	Warm Startup Time hrs	Hot Startup Time hrs	Shutdown Time hrs	Cold Starts events/yr	Warm Starts events/yr	Hot Starts events/yr	Estimated Shutdowns yr	Max Estimated Shutdowns day
	24	8000	0	0	0	0.65	0.583	0.5	0.417	5	35	0	40	0

	Cold Startup Emissions lbs/event	Warm Startup Emissions lbs/event	Hot Startup Emissions lbs/event	Shutdown Emissions lbs/event	Steady State Emissions w/o DB lbs/hr	Steady State Emissions w/DB lbs/hr	Worst Hr Emissions w/DB lbs/hr	Total Cold Start hrs/yr	Total Warm Start hrs/yr	Total Hot Start hrs/yr	Total Shutdown hrs/yr	Annual Steady State Non SU/SD hrs/yr	Total Annual Emissions Cold Starts lbs/yr	Warm Starts lbs/yr	Hot Starts lbs/yr	Shutdowns lbs/yr
					Case11	***Case 12***	***Case 2***									
NOx	51.48	46.80	43.20	33.00	16.70	18.10	18.50	3.25	20.405	0	16.68	7959.665	257.4	1638.0	0.00	1320.0
CO	415.80	378.00	304.80	75.90	10.20	11.00	11.30			Total SU-SD Hours/Yr:		40.335	2079.0	13230.0	0.00	3036.0
VOC	30.36	27.60	27.60	19.80	3.00	6.18	6.36				Steady State Hour Breakdown		151.8	966.0	0.00	792.0
SOx	0.88	0.88	0.75	0.75	1.40	1.50	1.50					Hrs/yr	4.4	30.8	0.00	30.0
PM10	7.56	7.56	6.48	4.07	9.70	11.70	11.80		Duct burner firing, max hours/yr:			1500	37.8	264.6	0.00	162.8
PM2.5	7.56	7.56	6.48	4.07	9.70	11.70	11.80		Non-duct burner firing, hours/yr:			6459.665	37.8	264.6	0.00	162.8
NH3	7.20	7.20	8.60	7.20	15.40	16.80	17.20						36.0	252.0	0.00	288.0

Notes:

Cold start plus shutdown =	1.067	hrs	ISO+ Day	ISO+ Day	Cold Day
Warm start plus shutdown =	1	hrs			
Hot start plus shutdown =	0.917	hrs			
Shut down =	0.417	hrs			

Annual Fuel Use Values	mmbtu/hr	hrs/yr		mmbtu/yr
Case11 w/o DB *	2221.42	6500		14439230
Case 12 w/DB	2409.55	1500		3614325
*includes SU/SD hours			Total =	18053555

Maximum Estimated Annual Emissions

Ops Scenario	NOx lbs/yr	CO lbs/yr	VOC lbs/yr	SOx lbs/yr	PM10 lbs/yr	PM2.5 lbs/yr	NH3 lbs/yr
Cold Startups	257.4	2079.0	151.8	4.4	37.8	37.8	
Warm Startups	1638.0	13230.0	966.0	30.8	264.6	264.6	
Hot Startups	0.0	0.0	0.0	0.0	0.0	0.0	
Shutdowns	1320.0	3036.0	792.0	30.0	162.8	162.8	
Steady State w/o DB	107876.4	65888.6	19379.0	9043.5	62658.8	62658.8	99478.8
Steady State w/DB	27150.0	16500.0	9270.0	2250.0	17550.0	17550.0	25200.0
1 Turbine Total, lbs/yr:	*138241.8*	*100733.6*	*30558.8*	*11358.7*	*80674.0*	*80674.0*	*124678.8*
1 Turbine Total, tons/yr:	69.12	50.37	15.28	5.68	40.34	40.34	62.34

		NOx tpy	CO tpy	VOC tpy	SOx tpy	PM10 tpy	PM2.5 tpy	NH3 tpy
	Total Tons/Yr All Units:	**138.24**	**100.73**	**30.56**	**11.36**	**80.67**	**80.67**	**124.68**
EPA	PSD Program Trigger Levels, TPY:	100	100	100	100	100	100	
EPA	PSD Significant Emissions Rates, TPY:	40	100	40	40	15	10	
AVAQMD	Air Agency Offset Trigger Levels, TPY:	25	100	25	25	15	15	

Maximum Estimated Daily Emissions based on a 24 Ops Cold Day

Max Daily Emissions Assumptions (Per turbine):		**Hours**
cold starts per day =	1	0.65
warm starts per day =	0	0
hot starts per day =	0	0
shutdowns per day =	1	0.417
Steady state ops hrs/day =		22.933

	lbs/day	lbs/day all units
NOx	508.74	1017.48
CO	750.84	1501.69
VOC	196.01	392.03
SOx	36.00	72.00
PM10	283.20	566.40
PM2.5	283.20	566.40
NH3	408.85	817.70

Maximum Estimated Hourly Emissions

Max hourly emissions assumptions (Per turbine):	Hours
1. Cold startup	0.65
2. remainder of hour, cold day no DB, Case 1	0.35
3. NH3 is cold day data-steady state	

	lbs/hr	lbs/hr All Units	Case 1 for used for remaining hour of start (lb/hr)
NOx	57.47	114.93	17.1
CO	419.44	838.88	10.4
VOC	31.41	62.82	3
SOx	1.50	3.00	1.4
PM10	11.80	23.60	9.8
PM2.5	11.80	23.60	9.8
NH3	12.73	25.46	15.8

GHG Emissions Estimates

Fuel:	Natural Gas				short		CO2e		
Btu/scf:	1024	HHV	*Emissions*	lbs/yr	tons/yr	IPCC SAR	short		
Heat Rate:	18053555	mmbtu/yr		2.11E+09	1.06E+06	Values	tons/yr		
Fuel Rate:	17630.4248	mmscf/yr		3.98E+04	1.99E+01	1	1.06E+06		
Emissions Factors				3.98E+03	1.99E+00	21	4.18E+02		
CO2	116.89	lbs/mmbtu				310	6.17E+02		
CH4	0.002205	lbs/mmbtu				Total CO2e:	1,056,175	short TPY	1 Engine
N2O	0.0002205	lbs/mmbtu				Total CO2e:	2,112,350	short TPY	All Engines
						Total CO2e:	960,159	metric TPY	1 Engine
Emissions Factors for GHG, 40 CFR 98, Subpart C, Tables C-1, C-2.						**Total CO2e:**	**1,920,318**	**metric TPY**	All Engines

1 short ton = 2000 lbs, 1 metric ton = 2200 lbs.

Notes:

1. Turbine emissions based on the following:
   - NOx 2.0 ppm
   - CO 2.0 ppm
   - VOC 1.0 - 2.0 ppm
2. Startup data has 20% and 10% margin added to the startup and shutdown emissions, respectively.
3. Cold start event data is based on 100% turbine load at end of start cycle
4. Short-term emissions based on 23 degree day
5. Annual emissions based on 64 degree day with 1500 hours of DB
6. GT+DB VOC at 2.2 ppm reduced to BACT level of 2.0 ppm

Data References:

1. Siemens, Summit Palmdale, 2x1 Estimated Stack Emissions Sheet, April 16, 2015
2. Siemens, Startup/Shutdown Emissions Sheet
3. Siemens, Summit Palmdale, 2x1 ACC, Performance Estimate Data Sheet, april 17, 2015
4. Siemens, Summit Palmdale, Total Plant Startup Curve, 2x1, SGT6-5000F with SST6-5000 ST, Rev 001, April 17, 2015
5. AVAQMD, FDOC, 5-13-2010, Table 1.

Aux Boiler

Calculation of Criteria Pollutant Emissions for Boilers Firing Gaseous Fuels

Boiler Operation Mode:	Normal Ops	# of Units:	1
Ops Hr/Day:	24	Fuel Type:	Nat Gas
Ops Hr/Yr:	836		

	Calculation of Criteria Pollutant Emissions from Each Identical Unit					All Units			
Compound	Emission Factor, lbs/mmbtu	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/dav	Maximum Annual Emissions, lbs/yr	Annual Emissions, ton/yr	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/dav	Maximum Annual Emissions, lbs/vr	Annual Emissions, ton/yr
NOx	0.0110	1.21	29.04	1011.56	0.51	1.21	29.04	1011.6	0.51
CO	0.0370	4.07	97.68	3402.52	1.70	4.07	97.68	3402.5	1.70
VOC	0.0060	0.66	15.84	551.76	0.28	0.66	15.84	551.8	0.28
SOx	0.0006	0.07	1.58	55.18	0.03	0.07	1.58	55.2	0.03
PM10	0.0070	0.77	18.48	643.72	0.32	0.77	18.48	643.7	0.32
PM2.5	0.0070	0.77	18.48	643.72	0.32	0.77	18.48	643.7	0.32
	lbs/MMbtu								
CO2	116.88800	12857.68	308584.32	10749020.48	5374.51	12857.68	308584.32	10749020.5	5374.51
Methane	0.00220	0.24	5.82	202.74	0.10	0.24	5.82	202.7	0.10
N2O	0.00022	0.02	0.58	20.27	0.01	0.02	0.58	20.3	0.01
CO2e								*short tons*	5380.1
								metric tons	4891.0

Notes:
(1) natural gas criteria pollutant EF factors
(2) Based on maximum hourly boiler fuel use of 110 MMBtu/hr/boiler
and fuel HHV of 1027 Btu/scf gives 0.1071 MMscf/hr/boiler.
(3) Based on maximum annual boiler fuel use of 91,960 MMBtu/yr/boiler
and fuel HHV of 1027 Btu/scf gives 89.5424 MMscf/yr/boiler.
(4) PM2.5 = PM10

Refs:
(1) EFs from PHPP 08-AFC-9, Appendix G
(2) GHG Factors and HHV value from 40 CFR 98.38, Tables C-1, C-2
(3) LNBs/FGR and GCPs
(4) SCR not proposed
(5) SO2 based on nat gas at 0.20 grs S/100scf

Maximum Emissions Totals for Ops Scenario (Turbines, DBs, Aux Boiler)

	NOx	CO	VOC	SOx	PM10	PM2.5	NH3	CO2e
lbs/hr	116.14	842.95	63.48	3.07	24.37	24.37	25.46	-
lbs/day	1019.90	1509.83	393.35	72.13	567.94	567.94	817.70	-
TPY	138.75	102.43	30.83	11.39	81.00	81.00	124.68	2117730

Table A-1B

Maximum Hourly, Daily, and Annual Emissions Calculations

Number of Identical Engines: 2

Case #: Ops Scenario 2 - Cold Day and ISO Cases — Turbine Model: SCC6-5000F

Input data per unit:

	Max Operation hrs/day	Max Annual Op hrs	Avg # of Cold Startups day	Avg # of Warm Startups day	Avg # of Hot Startups day	Cold Startup Time hrs	Warm Startup Time hrs	Hot Startup Time hrs	Shutdown Time hrs	Cold Starts events/yr	Warm Starts events/yr	Hot Starts events/yr	Estimated Shutdowns yr	Max Estimated Shutdowns day
	24	4320	0	1	1	0.65	0.583	0.5	0.417	5	360	360	725	2

	Cold Startup Emissions lbs/event	Warm Startup Emissions lbs/event	Hot Startup Emissions lbs/event	Shutdown Emissions lbs/event	Steady State Emissions w/o DB lbs/hr	Steady State Emissions w/DB lbs/hr	Worst Hr Emissions w/DB lbs/hr	Total Cold Start hrs/yr	Total Warm Start hrs/yr	Total Hot Start hrs/yr	Total Shutdown hrs/yr	Annual Steady State Non SU/SD hrs/yr	Total Annual Emissions Cold Starts lbs/yr	Warm Starts lbs/yr	Hot Starts lbs/yr	Shutdowns lbs/yr
					Case11	***Case 12***	***Case 2***									
NOx	51.48	46.80	43.20	33.00	16.70	18.10	18.50	3.25	209.88	180	302.325	3624.545	257.4	16848.0	15552.00	23925.0
CO	415.80	378.00	304.80	75.90	10.20	11.00	11.30				Total SU-SD Hours/Yr:	695.455	2079.0	136080.0	109728.00	55027.5
VOC	30.36	27.60	27.60	19.80	3.00	6.18	6.36					Steady State Hour Breakdown	151.8	9936.0	9936.00	14355.0
SOx	0.88	0.88	0.75	0.75	1.40	1.50	1.50					Hrs/yr	4.4	316.8	270.00	543.8
PM10	7.56	7.56	6.48	4.07	9.70	11.70	11.80		Duct burner firing, max hours/yr:			1500	37.8	2721.6	2332.80	2950.8
PM2.5	7.56	7.56	6.48	4.07	9.70	11.70	11.80		Non-duct burner firing, hours/yr:			2124.545	37.8	2721.6	2332.80	2950.8
NH3	7.20	7.20	8.60	7.20	15.40	16.80	17.20						36.0	2592.0	3096.00	5220.0
Notes:					ISO+ Day	ISO+ Day	Cold Day									

Cold start plus shutdown =	1.067	hrs	
Warm start plus shutdown =	1	hrs	
Hot start plus shutdown =	0.917	hrs	
Shut down =	0.417	hrs	

Annual Fuel Use Values	mmbtu/hr	hrs/yr		mmbtu/yr
Case11 w/o DB *	2221.42	2820		6264404.4
Case 12 w/DB	2409.55	1500		3614325
*includes SU/SD hours			Total =	9878729.4

Maximum Estimated Annual Emissions

Ops Scenario	NOx lbs/yr	CO lbs/yr	VOC lbs/yr	SOx lbs/yr	PM10 lbs/yr	PM2.5 lbs/yr	NH3 lbs/yr
Cold Startups	257.4	2079.0	151.8	4.4	37.8	37.8	
Warm Startups	16848.0	136080.0	9936.0	316.8	2721.6	2721.6	
Hot Startups	15552.0	109728.0	9936.0	270.0	2332.8	2332.8	
Shutdowns	23925.0	55027.5	14355.0	543.8	2950.8	2950.8	
Steady State w/o DB	35479.9	21670.4	6373.6	2974.4	20608.1	20608.1	32718.0
Steady State w/DB	27150.0	16500.0	9270.0	2250.0	17550.0	17550.0	25200.0
1 Turbine Total, lbs/yr:	*119212.3*	*341084.9*	*50022.4*	*6359.3*	*46201.0*	*46201.0*	*57918.0*
1 Turbine Total, tons/yr:	59.61	170.54	25.01	3.18	23.10	23.10	28.96

	NOx tpy	CO tpy	VOC tpy	SOx tpy	PM10 tpy	PM2.5 tpy	NH3 tpy
Total Tons/Yr All Units:	**119.21**	**341.08**	**50.02**	**6.36**	**46.20**	**46.20**	**57.92**
EPA PSD Program Trigger Levels, TPY:	100	100	100	100	100	100	
EPA PSD Significant Emissions Rates, TPY:	40	100	40	40	15	10	
AVAQMD Air Agency Offset Trigger Levels, TPY:	25	100	25	25	15	15	

Maximum Estimated Daily Emissions based on a 24 Ops Cold Day

Max Daily Emissions Assumptions (Per turbine):		**Hours**
cold starts per day =	0	0
warm starts per day =	1	0.583
hot starts per day =	1	0.5
shutdowns per day =	2	0.834
Steady state ops hrs/day =		22.083

	lbs/day	lbs/day all units
NOx	564.54	1129.07
CO	1084.14	2168.28
VOC	235.25	470.50
SOx	36.00	72.00
PM10	283.20	566.40
PM2.5	283.20	566.40
NH3	410.03	820.06

Maximum Estimated Hourly Emissions

Max hourly emissions assumptions (Per turbine):	Hours
1. Cold startup	0.65
2. remainder of hour, cold day no DB, Case 1	0.35
3. NH3 is cold day data-steady state	

	lbs/hr	lbs/hr All Units	Case 1 for used for remaining hour of start (lb/hr)
NOx	57.47	114.93	17.1
CO	419.44	838.88	10.4
VOC	31.41	62.82	3
SOx	1.50	3.00	1.4
PM10	11.80	23.60	9.8
PM2.5	11.80	23.60	9.8
NH3	12.73	25.46	15.8

GHG Emissions Estimates

Fuel:	Natural Gas				short		CO2e		
Btu/scf:	1027	HHV	*Emissions*	lbs/yr	tons/yr	IPCC SAR	short		
Heat Rate:	9878729.4	mmbtu/yr		1.15E+09	5.77E+05	Values	tons/yr		
Fuel Rate:	9619.0160	mmscf/yr		2.18E+04	1.09E+01	1	5.77E+05		
Emissions Factors				2.18E+03	1.09E+00	21	2.29E+02		
CO2	116.89	lbs/mmbtu				310	3.38E+02		
CH4	0.002205	lbs/mmbtu				Total CO2e:	577,929	short TPY	1 Engine
N2O	0.0002205	lbs/mmbtu				Total CO2e:	1,155,857	short TPY	All Engines
						Total CO2e:	525,390	metric TPY	1 Engine
Emissions Factors for GHG, 40 CFR 98, Subpart C, Tables C-1, C-2.						**Total CO2e:**	**1,050,779**	**metric TPY**	All Engines

1 short ton = 2000 lbs, 1 metric ton = 2200 lbs.

Notes:

1. Turbine emissions based on the following:
   - NOx 2.0 ppm
   - CO 2.0 ppm
   - VOC 1.0 - 2.0 ppm
2. Startup data has 20% and 10% margin added to the startup and shutdown emissions, respectively.
3. Cold start event data is based on 100% turbine load at end of start cycle
4. Short-term emissions based on 23 degree day
5. Annual emissions based on 64 degree day with 1500 hours of DB
6. GT+DB VOC at 2.2 ppm reduced to BACT level of 2.0 ppm

Data References:

1. Siemens, Summit Palmdale, 2x1 Estimated Stack Emissions Sheet, April 16, 2015
2. Siemens, Startup/Shutdown Emissions Sheet
3. Siemens, Summit Palmdale, 2x1 ACC, Performance Estimate Data Sheet, april 17, 2015
4. Siemens, Summit Palmdale, Total Plant Startup Curve, 2x1, SGT6-5000F with SST6-5000 ST, Rev 001, April 17, 2015
5. AVAQMD, FDOC, 5-13-2010, Table 1.

Aux Boiler

Calculation of Criteria Pollutant Emissions for Boilers Firing Gaseous Fuels

Boiler Operation Mode:	Normal Ops		# of Units:	1
Ops Hr/Day:	24		Fuel Type:	Nat Gas
Ops Hr/Yr:	4884			

		Calculation of Criteria Pollutant Emissions from Each Identical Unit				All Units			
Compound	Emission Factor, lbs/mmbtu	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/day	Maximum Annual Emissions, lbs/yr	Annual Emissions, ton/yr	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/day	Maximum Annual Emissions, lbs/yr	Annual Emissions, ton/yr
NOx	0.0110	1.21	29.04	5909.64	2.95	1.21	29.04	5909.6	2.95
CO	0.0370	4.07	97.68	19877.88	9.94	4.07	97.68	19877.9	9.94
VOC	0.0060	0.66	15.84	3223.44	1.61	0.66	15.84	3223.4	1.61
SOx	0.0006	0.07	1.58	322.34	0.16	0.07	1.58	322.3	0.16
PM10	0.0070	0.77	18.48	3760.68	1.88	0.77	18.48	3760.7	1.88
PM2.5	0.0070	0.77	18.48	3760.68	1.88	0.77	18.48	3760.7	1.88
	lbs/MMbtu								
CO2	116.88800	12857.68	308584.32	62796909.12	31398.45	12857.68	308584.32	62796909.1	31398.45
Methane	0.00220	0.24	5.82	1184.40	0.59	0.24	5.82	1184.4	0.59
N2O	0.00022	0.02	0.58	118.44	0.06	0.02	0.58	118.4	0.06
CO2e								*short tons*	31430.9
								metric tons	28573.8

Notes:
(1) natural gas criteria pollutant EF factors
(2) Based on maximum hourly boiler fuel use of 110 MMBtu/hr/boiler
and fuel HHV of 1027 Btu/scf gives 0.1071 MMscf/hr/boiler.
(3) Based on maximum annual boiler fuel use of 537,240 MMBtu/yr/boiler
and fuel HHV of 1027 Btu/scf gives 523.1159 MMscf/yr/boiler.
(4) PM2.5 = PM10

Refs:
(1) EFs from PHPP 08-AFC-9, Appendix G
(2) GHG Factors and HHV value from 40 CFR 98.38, Tables C-1, C-2
(3) LNBs/FGR and GCPs
(4) SCR not proposed
(5) SO2 based on nat gas at 0.20 grs S/100scf

Maximum Emissions Totals for Ops Scenario (Turbines, DBs, Aux Boiler)

	NOx	CO	VOC	SOx	PM10	PM2.5	NH3	CO2e
lbs/hr	116.14	842.95	63.48	3.07	24.37	24.37	25.46	-
lbs/day	1131.49	2176.42	471.82	72.13	567.94	567.94	820.06	-
TPY	122.17	351.02	51.63	6.52	48.08	48.08	57.92	1187288

Table A-1C

Maximum Hourly, Daily, and Annual Emissions Calculations

Number of Identical Engines: 2
Turbine Model: SCC6-5000F

Case #: Ops Scenario 3 - Cold Day and ISO Cases

Input data per unit:

Max Operation hrs/day	Max Annual Op hrs	Avg # of Cold Startups day	Avg # of Warm Startups day	Avg # of Hot Startups day	Cold Startup Time hrs	Warm Startup Time hrs	Hot Startup Time hrs	Shutdown Time hrs	Cold Starts events/yr	Warm Starts events/yr	Hot Starts events/yr	Estimated Shutdowns yr	Max Estimated Shutdowns day
24	5000	0	1	1	0.65	0.583	0.5	0.417	5	360	180	545	2

	Cold Startup Emissions lbs/event	Warm Startup Emissions lbs/event	Hot Startup Emissions lbs/event	Shutdown Emissions lbs/event	Steady State Emissions w/o DB lbs/hr	Steady State Emissions w/DB lbs/hr	Worst Hr Emissions w/DB lbs/hr	Total Cold Start hrs/yr	Total Warm Start hrs/yr	Total Hot Start hrs/yr	Total Shutdown hrs/yr	Annual Steady State Non SU/SD hrs/yr	Total Annual Emissions Cold Starts lbs/yr	Warm Starts lbs/yr	Hot Starts lbs/yr	Shutdowns lbs/yr
					Case11	***Case 12***	***Case 2***									
NOx	51.48	46.80	43.20	33.00	16.70	18.10	18.50	3.25	209.88	90	227.265	4469.605	257.4	16848.0	7776.00	17985.0
CO	415.80	378.00	304.80	75.90	10.20	11.00	11.30				Total SU-SD Hours/Yr:	530.395	2079.0	136080.0	54864.00	41365.5
VOC	30.36	27.60	27.60	19.80	3.00	6.18	6.36					Steady State Hour Breakdown	151.8	9936.0	4968.00	10791.0
SOx	0.88	0.88	0.75	0.75	1.40	1.50	1.50					Hrs/yr	4.4	316.8	135.00	408.8
PM10	7.56	7.56	6.48	4.07	9.70	11.70	11.80		Duct burner firing, max hours/yr:			1500	37.8	2721.6	1166.40	2218.2
PM2.5	7.56	7.56	6.48	4.07	9.70	11.70	11.80		Non-duct burner firing, hours/yr:			2969.605	37.8	2721.6	1166.40	2218.2
NH3	7.20	7.20	8.60	7.20	15.40	16.80	17.20						36.0	2592.0	1548.00	3924.0
Notes:					ISO+ Day	ISO+ Day	Cold Day									

Cold start plus shutdown =	1.067	hrs	
Warm start plus shutdown =	1	hrs	
Hot start plus shutdown =	0.917	hrs	
Shut down =	0.417	hrs	

Annual Fuel Use Values	mmbtu/hr	hrs/yr		mmbtu/yr
Case11 w/o DB *	2221.42	3500		7774970
Case 12 w/DB	2409.55	1500		3614325
*includes SU/SD hours			Total =	11389295

Maximum Estimated Annual Emissions

Ops Scenario	NOx lbs/yr	CO lbs/yr	VOC lbs/yr	SOx lbs/yr	PM10 lbs/yr	PM2.5 lbs/yr	NH3 lbs/yr
Cold Startups	257.4	2079.0	151.8	4.4	37.8	37.8	
Warm Startups	16848.0	136080.0	9936.0	316.8	2721.6	2721.6	
Hot Startups	7776.0	54864.0	4968.0	135.0	1166.4	1166.4	
Shutdowns	17985.0	41365.5	10791.0	408.8	2218.2	2218.2	
Steady State w/o DB	49592.4	30290.0	8908.8	4157.4	28805.2	28805.2	45731.9
Steady State w/DB	27150.0	16500.0	9270.0	2250.0	17550.0	17550.0	25200.0
1 Turbine Total, lbs/yr:	*119608.8*	*281178.5*	*44025.6*	*7272.4*	*52499.1*	*52499.1*	*70931.9*
1 Turbine Total, tons/yr:	59.80	140.59	22.01	3.64	26.25	26.25	35.47

		NOx tpy	CO tpy	VOC tpy	SOx tpy	PM10 tpy	PM2.5 tpy	NH3 tpy
	Total Tons/Yr All Units:	**119.61**	**281.18**	**44.03**	**7.27**	**52.50**	**52.50**	**70.93**
EPA	PSD Program Trigger Levels, TPY:	100	100	100	100	100	100	
EPA	PSD Significant Emissions Rates, TPY:	40	100	40	40	15	10	
AVAQMD	Air Agency Offset Trigger Levels, TPY:	25	100	25	25	15	15	

Maximum Estimated Daily Emissions based on a 24 Ops Cold Day

Max Daily Emissions Assumptions (Per turbine):		**Hours**
cold starts per day =	0	0
warm starts per day =	1	0.583
hot starts per day =	1	0.5
shutdowns per day =	2	0.834
Steady state ops hrs/day =		22.083

	lbs/day	lbs/day all units
NOx	564.54	1129.07
CO	1084.14	2168.28
VOC	235.25	470.50
SOx	36.00	72.00
PM10	283.20	566.40
PM2.5	283.20	566.40
NH3	410.03	820.06

Maximum Estimated Hourly Emissions

Max hourly emissions assumptions (Per turbine):	Hours
1. Cold startup	0.65
2. remainder of hour, cold day no DB, Case 1	0.35
3. NH3 is cold day data-steady state	

	lbs/hr	lbs/hr All Units	Case 1 for used for remaining hour of start (lb/hr)
NOx	57.47	114.93	17.1
CO	419.44	838.88	10.4
VOC	31.41	62.82	3
SOx	1.50	3.00	1.4
PM10	11.80	23.60	9.8
PM2.5	11.80	23.60	9.8
NH3	12.73	25.46	15.8

GHG Emissions Estimates

Fuel:	Natural Gas				short		CO2e		
Btu/scf:	1027	HHV	*Emissions*	lbs/yr	tons/yr	IPCC SAR	short		
Heat Rate:	11389295	mmbtu/yr		1.33E+09	6.66E+05	Values	tons/yr		
Fuel Rate:	11089.8685	mmscf/yr		2.51E+04	1.26E+01	1	6.66E+05		
Emissions Factors				2.51E+03	1.26E+00	21	2.64E+02		
CO2	116.89	lbs/mmbtu				310	3.89E+02		
CH4	0.002205	lbs/mmbtu				Total CO2e:	666,300	short TPY	1 Engine
N2O	0.0002205	lbs/mmbtu				Total CO2e:	1,332,601	short TPY	All Engines
						Total CO2e:	605,728	metric TPY	1 Engine
Emissions Factors for GHG, 40 CFR 98, Subpart C, Tables C-1, C-2.						**Total CO2e:**	**1,211,455**	**metric TPY**	All Engines

1 short ton = 2000 lbs, 1 metric ton = 2200 lbs.

Notes:

1. Turbine emissions based on the following:
   - NOx 2.0 ppm
   - CO 2.0 ppm
   - VOC 1.0 - 2.0 ppm
2. Startup data has 20% and 10% margin added to the startup and shutdown emissions, respectively.
3. Cold start event data is based on 100% turbine load at end of start cycle
4. Short-term emissions based on 23 degree day
5. Annual emissions based on 64 degree day with 1500 hours of DB
6. GT+DB VOC at 2.2 ppm reduced to BACT level of 2.0 ppm

Data References:

1. Siemens, Summit Palmdale, 2x1 Estimated Stack Emissions Sheet, April 16, 2015
2. Siemens, Startup/Shutdown Emissions Sheet
3. Siemens, Summit Palmdale, 2x1 ACC, Performance Estimate Data Sheet, april 17, 2015
4. Siemens, Summit Palmdale, Total Plant Startup Curve, 2x1, SGT6-5000F with SST6-5000 ST, Rev 001, April 17, 2015
5. AVAQMD, FDOC, 5-13-2010, Table 1.

Aux Boiler

Calculation of Criteria Pollutant Emissions for Boilers Firing Gaseous Fuels

Boiler Operation Mode:	Normal Ops		# of Units:	1
Ops Hr/Day:	24		Fuel Type:	Nat Gas
Ops Hr/Yr:	4136			

		Calculation of Criteria Pollutant Emissions from Each Identical Unit				All Units			
Compound	Emission Factor, lbs/mmbtu	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/dav	Maximum Annual Emissions, lbs/vr	Annual Emissions, ton/yr	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/dav	Maximum Annual Emissions, lbs/vr	Annual Emissions, ton/yr
NOx	0.0110	1.21	29.04	5004.56	2.50	1.21	29.04	5004.6	2.50
CO	0.0370	4.07	97.68	16833.52	8.42	4.07	97.68	16833.5	8.42
VOC	0.0060	0.66	15.84	2729.76	1.36	0.66	15.84	2729.8	1.36
SOx	0.0006	0.07	1.58	272.98	0.14	0.07	1.58	273.0	0.14
PM10	0.0070	0.77	18.48	3184.72	1.59	0.77	18.48	3184.7	1.59
PM2.5	0.0070	0.77	18.48	3184.72	1.59	0.77	18.48	3184.7	1.59
	lbs/MMbtu								
CO2	116.88800	12857.68	308584.32	53179364.48	26589.68	12857.68	308584.32	53179364.5	26589.68
Methane	0.00220	0.24	5.82	1003.00	0.50	0.24	5.82	1003.0	0.50
N2O	0.00022	0.02	0.58	100.30	0.05	0.02	0.58	100.3	0.05
CO2e								*short tons*	26617.2
								metric tons	24197.7

Notes:
(1) natural gas criteria pollutant EF factors
(2) Based on maximum hourly boiler fuel use of 110 MMBtu/hr/boiler
and fuel HHV of 1027 Btu/scf gives 0.1071 MMscf/hr/boiler.
(3) Based on maximum annual boiler fuel use of 454,960 MMBtu/yr/boiler
and fuel HHV of 1027 Btu/scf gives 442.9990 MMscf/yr/boiler.
(4) PM2.5 = PM10

Refs:
(1) EFs from PHPP 08-AFC-9, Appendix G
(2) GHG Factors and HHV value from 40 CFR 98.38, Tables C-1, C-2
(3) LNBs/FGR and GCPs
(4) SCR not proposed
(5) SO2 based on nat gas at 0.20 grs S/100scf

Maximum Emissions Totals for Ops Scenario (Turbines, DBs, Aux Boiler)

	NOx	CO	VOC	SOx	PM10	PM2.5	NH3	CO2e
lbs/hr	116.14	842.95	63.48	3.07	24.37	24.37	25.46	-
lbs/day	1131.49	2176.42	471.82	72.13	567.94	567.94	820.06	-
TPY	122.11	289.60	45.39	7.41	54.09	54.09	70.93	1359218

Table A-2
Calculation of Hazardous and Toxic Pollutant Emissions

# of Units:	2	
Fuel HHV:	1024	btu/scf

Calculation of Noncriteria Pollutant Emissions from Gas Turbines

Compound	Emission Factor, lb/MMscf	CO Catalyst Control Multiplier	(each turbine) Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/day	Annual Emissions, lb/yr	All Turbines Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/day	Annual Emissions, lb/yr	Annual Emissions, tons/yr
Acetaldehyde	1.37E-01	2.00E-01	6.60E-02	1.58E+00	4.83E+02	1.32E-01	3.17E+00	9.66E+02	4.83E-01
Acrolein	1.89E-02	2.00E-01	9.11E-03	2.19E-01	6.66E+01	1.82E-02	4.37E-01	1.33E+02	6.66E-02
Ammonia	(3)		1.72E+01	4.13E+02	1.38E+05	3.44E+01	8.26E+02	2.75E+05	1.38E+02
Benzene	1.33E-02	2.00E-01	6.41E-03	1.54E-01	4.69E+01	1.28E-02	3.08E-01	9.38E+01	4.69E-02
1,3-Butadiene	1.27E-04	2.00E-01	6.12E-05	1.47E-03	4.48E-01	1.22E-04	2.94E-03	8.96E-01	4.48E-04
Ethylbenzene	1.79E-02	2.00E-01	8.63E-03	2.07E-01	6.31E+01	1.73E-02	4.14E-01	1.26E+02	6.31E-02
Formaldehyde	9.17E-01	5.00E-01	1.10E+00	2.65E+01	8.08E+03	2.21E+00	5.30E+01	1.62E+04	8.08E+00
Hexane	2.59E-01	2.00E-01	1.25E-01	3.00E+00	9.13E+02	2.50E-01	5.99E+00	1.83E+03	9.13E-01
Naphthalene	1.66E-03	2.00E-01	8.00E-04	1.92E-02	5.85E+00	1.60E-03	3.84E-02	1.17E+01	5.85E-03
Total PAHs	2.41E-04	2.00E-01	1.16E-04	2.79E-03	8.50E-01	2.32E-04	5.57E-03	1.70E+00	8.50E-04
Propylene	7.71E-01	2.00E-01	3.72E-01	8.92E+00	2.72E+03	7.43E-01	1.78E+01	5.44E+03	2.72E+00
Propylene oxide	4.78E-02	2.00E-01	2.30E-02	5.53E-01	1.69E+02	4.61E-02	1.11E+00	3.37E+02	1.69E-01
Toluene	7.10E-02	2.00E-01	3.42E-02	8.21E-01	2.50E+02	6.84E-02	1.64E+00	5.01E+02	2.50E-01
Xylene	2.61E-02	2.00E-01	1.26E-02	3.02E-01	9.20E+01	2.52E-02	6.04E-01	1.84E+02	9.20E-02
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
*	0.00E+00	5.00E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Notes:

(1) Provided by CATEF database.

(2) Based on maximum hourly turbine fuel use of: 2.4093E+00 mmscf/hr
Case 2, cold day, with duct firing
Based on a maximum daily turbine fuel use of: 5.7823E+01 mmscf/day
Case 2, cold day, with duct firing
Based on maximum annual turbine fuel use of: 1.7630E+04 mmscf/yr
Cases 11 and 12, ISO day, with and without duct firing
Fuel use values from Fuel Calculation Sheet

(3) Values from ammonia slip calculations by Siemens, Case 12, ISO Day

(4) Fuel use values include HRSG duct burner(s) Yes or No: Yes

CO Catalyst Control Efficiencies

	Control Frac.	Multiplier
Organic HAPs	0.80	0.20
Inorganic HAPs	0.50	0.50

Each Turbine	24	Max hrs/day
Each Turbine	8000	Max Hrs/yr

Table A-3 Startup and Shutdown Emissions Estimates

Mode	Time (min)	Pounds per Event					Pounds per Event with margin				
		NOx	CO	VOC	PM	Fuel Use	NOx	CO	VOC	PM	Fuel Use
"Cold" Startup (GT Ignition to Emissions Compliance @ 70% GT Load)	35	34	312	22	5.1	37,601	40.8	374.4	26.4	6.12	37,601
"Cold" Startup (GT Ignition to Emissions Compliance @ 100% GT Load)	39	42.9	346.5	25.3	6.93	51,139	51.48	415.8	30.36	8.316	51,139
"Warm" Startup (GT Ignition to Emissions Compliance @ 100% GT Load)	35	39	315	23	6.3	46,490	46.8	378	27.6	7.56	46,490
"Hot" Startup (GT Ignition to Emissions Compliance @ 100% GT Load)	30	36	254	23	5.4	38,303	43.2	304.8	27.6	6.48	38,303
Shutdown (50% GT Load to Fuel Cut Off)	11	26	67	17	1.5	7,339	28.6	73.7	18.7	1.65	7,339
Shutdown (100% GT Load to Fuel Cut Off)	25	30	69	18	3.7	26,543	33	75.9	19.8	4.07	26,543

Assumes 20% margin on startup
Assumes 10% margin on shutdown

Table A-4A Aux Boiler

Calculation of Hazardous Air Pollutant Emissions for Boilers Firing Gaseous Fuels

Boiler Operation Mode:	Scenario 1		# of Units:	1
Max Hourly Fuel Use:	0.1074	mmscf	Fuel Type:	Nat Gas
Hrs/Yr:	836			
Max Annual Fuel Use:	89.7864	mmscf/yr		

Calculation of Hazardous Air Pollutant Emissions from Each Identical Unit

HAP	Emission Factor, lb/MMscf (1)	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/day	Maximum Annual Emissions, lbs/yr	Annual Emissions, ton/yr	All Units Maximum Hourly Emissions, lb/hr	All Units Maximum Daily Emissions, lb/day	All Units Maximum Annual Emissions, lbs/yr	All Units Annual Emissions, ton/yr
Acetaldehyde	9.00E-04	9.67E-05	n/a	8.08E-02	4.04E-05	9.67E-05	n/a	8.08E-02	4.04E-05
Acrolein	8.00E-04	8.59E-05	n/a	7.18E-02	3.59E-05	8.59E-05	n/a	7.18E-02	3.59E-05
Ammonia		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Benzene	1.70E-03	1.83E-04	n/a	1.53E-01	7.63E-05	1.83E-04	n/a	1.53E-01	7.63E-05
1,3-Butadiene	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Ethylbenzene	2.00E-03	2.15E-04	n/a	1.80E-01	8.98E-05	2.15E-04	n/a	1.80E-01	8.98E-05
Formaldehyde	3.60E-03	3.87E-04	n/a	3.23E-01	1.62E-04	3.87E-04	n/a	3.23E-01	1.62E-04
Hexane	1.30E-03	1.40E-04	n/a	1.17E-01	5.84E-05	1.40E-04	n/a	1.17E-01	5.84E-05
Naphthalene	3.00E-04	3.22E-05	n/a	2.69E-02	1.35E-05	3.22E-05	n/a	2.69E-02	1.35E-05
PAHs (4)	1.00E-04	1.07E-05	n/a	8.98E-03	4.49E-06	1.07E-05	n/a	8.98E-03	4.49E-06
Propylene	1.55E-02	1.66E-03	n/a	1.39E+00	6.96E-04	1.66E-03	n/a	1.39E+00	6.96E-04
Propylene oxide	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Toluene	7.80E-03	8.38E-04	n/a	7.00E-01	3.50E-04	8.38E-04	n/a	7.00E-01	3.50E-04
Xylene	5.80E-03	6.23E-04	n/a	5.21E-01	2.60E-04	6.23E-04	n/a	5.21E-01	2.60E-04
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00

Notes:
(1) natural gas HAPs emission factors: Hidden Hills AFC, Table 5.1B-14R, April 2012.
(2) Fuel HHV 1024 btu/scf
(3) Polycyclic aromatic hydrocarbons, excluding naphthalene (treated separately).
(4) LNB with FGR and GCPs
(5) all fuel values based on full load equivalents per PEP Aux boiler data sheets

Table A-4B Aux Boiler

Calculation of Hazardous Air Pollutant Emissions for Boilers Firing Gaseous Fuels

Boiler Operation Mode:	Scenario 2		# of Units:	1
Max Hourly Fuel Use:	0.1074	mmscf	Fuel Type:	Nat Gas
Hrs/Yr:	4884			
Max Annual Fuel Use:	524.5416	mmscf/yr		

Calculation of Hazardous Air Pollutant Emissions from Each Identical Unit

HAP	Emission Factor, lb/MMscf (1)	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/day	Maximum Annual Emissions, lbs/yr	Annual Emissions, ton/yr	All Units: Maximum Hourly Emissions, lb/hr	All Units: Maximum Daily Emissions, lb/day	All Units: Maximum Annual Emissions, lbs/yr	All Units: Annual Emissions, ton/yr
Acetaldehyde	9.00E-04	9.67E-05	n/a	4.72E-01	2.36E-04	9.67E-05	n/a	4.72E-01	2.36E-04
Acrolein	8.00E-04	8.59E-05	n/a	4.20E-01	2.10E-04	8.59E-05	n/a	4.20E-01	2.10E-04
Ammonia		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Benzene	1.70E-03	1.83E-04	n/a	8.92E-01	4.46E-04	1.83E-04	n/a	8.92E-01	4.46E-04
1,3-Butadiene	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Ethylbenzene	2.00E-03	2.15E-04	n/a	1.05E+00	5.25E-04	2.15E-04	n/a	1.05E+00	5.25E-04
Formaldehyde	3.60E-03	3.87E-04	n/a	1.89E+00	9.44E-04	3.87E-04	n/a	1.89E+00	9.44E-04
Hexane	1.30E-03	1.40E-04	n/a	6.82E-01	3.41E-04	1.40E-04	n/a	6.82E-01	3.41E-04
Naphthalene	3.00E-04	3.22E-05	n/a	1.57E-01	7.87E-05	3.22E-05	n/a	1.57E-01	7.87E-05
PAHs (4)	1.00E-04	1.07E-05	n/a	5.25E-02	2.62E-05	1.07E-05	n/a	5.25E-02	2.62E-05
Propylene	1.55E-02	1.66E-03	n/a	8.13E+00	4.07E-03	1.66E-03	n/a	8.13E+00	4.07E-03
Propylene oxide	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Toluene	7.80E-03	8.38E-04	n/a	4.09E+00	2.05E-03	8.38E-04	n/a	4.09E+00	2.05E-03
Xylene	5.80E-03	6.23E-04	n/a	3.04E+00	1.52E-03	6.23E-04	n/a	3.04E+00	1.52E-03
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00

Notes:
(1) natural gas HAPs emission factors: Hidden Hills AFC, Table 5.1B-14R, April 2012.
(2) Fuel HHV 1024 btu/scf
(3) Polycyclic aromatic hydrocarbons, excluding naphthalene (treated separately).
(4) LNB with FGR and GCPs
(5) all fuel values based on full load equivalents per PEP Aux boiler data sheets

Table A-4C Aux Boiler

Calculation of Hazardous Air Pollutant Emissions for Boilers Firing Gaseous Fuels

Boiler Operation Mode:	Scenario 3		# of Units:	1
Max Hourly Fuel Use:	0.1074	mmscf	Fuel Type:	Nat Gas
Hrs/Yr:	4136			
Max Annual Fuel Use:	444.2064	mmscf/yr		

Calculation of Hazardous Air Pollutant Emissions from Each Identical Unit

						All Units			
HAP	Emission Factor, lb/MMscf (1)	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/day	Maximum Annual Emissions, lbs/yr	Annual Emissions, ton/yr	Maximum Hourly Emissions, lb/hr	Maximum Daily Emissions, lb/day	Maximum Annual Emissions, lbs/yr	Annual Emissions, ton/yr
Acetaldehyde	9.00E-04	9.67E-05	n/a	4.00E-01	2.00E-04	9.67E-05	n/a	4.00E-01	2.00E-04
Acrolein	8.00E-04	8.59E-05	n/a	3.55E-01	1.78E-04	8.59E-05	n/a	3.55E-01	1.78E-04
Ammonia		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Benzene	1.70E-03	1.83E-04	n/a	7.55E-01	3.78E-04	1.83E-04	n/a	7.55E-01	3.78E-04
1,3-Butadiene	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Ethylbenzene	2.00E-03	2.15E-04	n/a	8.88E-01	4.44E-04	2.15E-04	n/a	8.88E-01	4.44E-04
Formaldehyde	3.60E-03	3.87E-04	n/a	1.60E+00	8.00E-04	3.87E-04	n/a	1.60E+00	8.00E-04
Hexane	1.30E-03	1.40E-04	n/a	5.77E-01	2.89E-04	1.40E-04	n/a	5.77E-01	2.89E-04
Naphthalene	3.00E-04	3.22E-05	n/a	1.33E-01	6.66E-05	3.22E-05	n/a	1.33E-01	6.66E-05
PAHs (4)	1.00E-04	1.07E-05	n/a	4.44E-02	2.22E-05	1.07E-05	n/a	4.44E-02	2.22E-05
Propylene	1.55E-02	1.66E-03	n/a	6.89E+00	3.44E-03	1.66E-03	n/a	6.89E+00	3.44E-03
Propylene oxide	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
Toluene	7.80E-03	8.38E-04	n/a	3.46E+00	1.73E-03	8.38E-04	n/a	3.46E+00	1.73E-03
Xylene	5.80E-03	6.23E-04	n/a	2.58E+00	1.29E-03	6.23E-04	n/a	2.58E+00	1.29E-03
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00
		0.00E+00	n/a	0.00E+00	0.00E+00	0.00E+00	n/a	0.00E+00	0.00E+00

Notes:

(1) natural gas HAPs emission factors: Hidden Hills AFC, Table 5.1B-14R, April 2012.

(2) Fuel HHV 1024 btu/scf

(3) Polycyclic aromatic hydrocarbons, excluding naphthalene (treated separately).

(4) LNB with FGR and GCPs

(5) all fuel values based on full load equivalents per PEP Aux boiler data sheets

Table A-5 Emergency Gen Set Emissions Estimates

EXPECTED INTERNAL COMBUSTION ENGINE EMISSIONS

Liquid Fuel

Emergency Generator

# of Identical Engines: 1

Mfg:	Caterpillar 3512C or Similar Engine	
Engine #:	2015 Family FCPXL78.1NZS	
kWe:	1500	
BHP:	2011	
RPM:	1800	
Fuel:	#2 Diesel	
Fuel Use:	104.6	gal/hr
FuelHHV:	139000	Btu/gal
mmbtu/hr:	14.54	HHV
Fuel Wt:	6.87	lbs/gal
Fuel S:	0.0015	% wt.
Fuel S:	0.10305	lbs/1000 gal
SO2:	0.2061	lbs/1000 gal
SO2:	9.779	equiv.g/hr

Stack Data

Height:	20	Ft.(1)	6.096 meters
Diameter:	0.6667	Ft.	0.2032 meters
Temp:	759	deg F	677.04 Kelvins
ACFM:	10908.7		158.76 m/s

input the mfg ACFM or calculate per Exhaust sheet)

Area:	0.349	Sq.Ft.
Velocity:	521	Ft/Sec

Max Daily Op Hrs/Emission Calcs Only: 1

Max Annual Op Hrs: 26

If the engines will operate less than an hour for purposes of testing, the modeled emissions rates adjusted below accordingly.

		--- for 60 mins/hour ---		Single Engine				*All Engines*			
Emissions	**EF(g/hp-hr)**	**g/hr**	**g/s**	**Lb/Hr**	**Lb/Day**	**Lbs/Yr**	**Tons/Yr**	***Lb/Hr***	***Lb/Day***	***Lbs/Yr***	***Tons/Yr***
NOx	3.78	7601.58	2.112	16.758	16.758	435.7	0.218	*16.758*	*16.758*	*435.7*	*0.218*
CO	0.67	1347.37	0.374	2.970	2.970	77.2	0.039	*2.970*	*2.970*	*77.2*	*0.039*
HC	0.19	382.09	0.106	0.842	0.842	21.9	0.011	*0.842*	*0.842*	*21.9*	*0.011*
PM (2)	0.09	180.99	0.050	0.399	0.399	10.4	0.005	*0.399*	*0.399*	*10.4*	*0.005*
SOx (3)	NA	9.779	0.003	0.022	0.0216	0.56	0.0003	*0.0216*	*0.0216*	*0.56*	*0.0003*

Notes:

(1) Stack height set equal to 3.5' above structure height

(2) PM10/PM2.5 equals PM, used in HRA for DPM emissions

(3) Based on ultralow (15 ppm) sulfur fuel

(4) Based on 1.3409 bhp per kWe

Modeled Emission Rates	**g/s**	
	1-hr NOx	1.056	
0.5 hr/test	Ann NOx	6.267E-3	*and 1-hr NO2 NAAQS*
1 test/day	1-hr CO	0.187	
	8-hr CO	0.023	
	1-hr SO2	1.358E-3	
	3-hr SO2	4.527E-4	
	24-hr SO2	5.659E-5	
	24-hr PM	1.047E-3	
	Ann PM	1.492E-4	

Table A-5 Page 2 Greenhouse Gas Emissions Calculator

IC Engines-Diesel Fuel

Emissions Analysis Period: Annual

Facility Name: Palmdale Energy Project

Oil Type: Distillate
Grade: #2 ULS

IC Engine Device ID: Emergency Gen Set
Op Hours: 26 Year

Engine Hp:	2011		Default Fuel Use Factor:	0	gal/hp-hr
Engine Heat Rating:	14.54	mmbtu/hr	Estimated Fuel Use Rate:	104.6	gal/hr
Oil Btu Content:	5.838	mmbtu/bbl			
Annual Oil Usage:	64.75505	bbls/yr	Carbon Content:	19.95	kg/mmbtu
	3.78E+02	mmbtu/yr	Frac Oxidized:	0.99	
Emissions Factors:			CO2/C Ratio:	3.6667	
CO2	73.96	kg/mmbtu or	Adjusted EF	72.4185	kg CO2/mmbtu
CH4	0.003	kg/mmbtu			
N2O	0.0006	kg/mmbtu			

	kg/yr	**Emissions** metric tons/yr	IPCC GWP/SAR	CO2e metric tons/yr
CO2	2.74E+04	27.37709	1	27.37709
CH4	1.13E+00	0.001134	21	0.023817
N2O	2.27E-01	0.000227	310	0.070315

Total **27.5** **CO2e metric tons/yr**
30.2 CO2e short tons/yr

Source Specific Emissions Factor References, Data Notes, or Calculation Notes:
1. Default diesel fuel heat content = 139,000 btu/gal
2. Fuel use rate provided by mfg specification sheet, applicant, or see footnote 3.
3. Default fuel use factor from SCAQMD Rule 21 Staff Report, March 1995.
4. Ops data from PEP
5. EF Ref: FR 74, #209, Part 98 Subpart C, 10-30-2009, Pg. 56409-56411, Table C-1 and C-2.

Table A-6 Fire Pump Emissions Estimates

EXPECTED INTERNAL COMBUSTION ENGINE EMISSIONS

Liquid Fuel

Emergency Fire Pump

# of Identical Engines: 1

Mfg:	Clarke or Similar Engine	
Engine #:	#N/A	
kWe:	#N/A	
BHP:	140	
RPM:	1760	
Fuel:	#2 Diesel	
Fuel Use:	9.2	gal/hr
FuelHHV:	139000	Btu/gal
mmbtu/hr:	1.28	HHV
Fuel Wt:	6.87	lbs/gal
Fuel S:	0.0015	% wt.
Fuel S:	0.10305	lbs/1000 gal
SO2:	0.2061	lbs/1000 gal
SO2:	0.860	equiv.g/hr

Stack Data

Height:	19.5	Ft.(1)	5.944 meters
Diameter:	0.4167	Ft.	0.1270 meters
Temp:	1023	deg F	823.71 Kelvins
ACFM:	755		28.13 m/s

input the mfg ACFM or calculate per Exhaust sheet)

Area:	0.1364	Sq.Ft.
Velocity:	92.28	Ft/Sec
Max Daily Op Hrs:	1	
Max Annual Op Hrs:	52	

If the engines will operate less than an hour for purposes of testing, correct the modeled emissions rates accordingly.

		--- for 60 mins/hour ---		Single Engine				*All Engines*			
Emissions	**g/hp-hr**	**EF(g/hr)**	**g/s**	**Lb/Hr**	**Lb/Day**	**Lbs/Yr**	**Tons/Yr**	***Lb/Hr***	***Lb/Day***	***Lbs/Yr***	***Tons/Yr***
NOx	2.80	392	0.109	0.864	0.864	44.9	0.022	*0.864*	*0.864*	*44.9*	*0.022*
CO	3.70	518	0.144	1.142	1.142	59.4	0.030	*1.142*	*1.142*	*59.4*	*0.030*
HC	0.20	28	7.778E-3	6.173E-2	6.173E-2	3.2	0.002	*0.062*	*0.062*	*3.2*	*0.002*
PM (2)	0.22	30.8	8.556E-3	6.790E-2	6.790E-2	3.5	0.002	*0.068*	*0.068*	*3.5*	*0.002*
SOx (3)	NA	0.860	2.389E-4	1.896E-3	1.896E-3	0.10	4.930E-5	*0.0019*	*0.0019*	*0.10*	*0.0000*
		140	client EF based on 0.25%s								

Notes:

(1) Stack height set equal to 3.5' above structure height

(2) PM10/PM2.5 equals PM, used in HRA for DPM emissions

(3) SOx EF 140 g/hr equal to sulfur content o 15 ppm

~0.01 %s

Modeled Emission Rates **g/s**

	1-hr NOx	0.109	
1 hr/test	Ann NOx	6.464E-4	*and 1-hr NO2 NAAQS*
1 test/day	1-hr CO	0.144	
	8-hr CO	0.018	
	1-hr SO2	2.389E-4	
	3-hr SO2	7.964E-5	
	24-hr SO2	9.954E-6	
	24-hr PM	3.565E-4	
	Ann PM	5.079E-5	

Table A-6 Page 2 Greenhouse Gas Emissions Calculator

IC Engines-Diesel Fuel

Emissions Analysis Period: Annual

Facility Name:	Palmdale Energy Project				Oil Type:	Distillate	
					Grade:	#2 ULS	
IC Engine Device ID:	Fire Pump				Op Hours:	52	Year
Engine Hp:	140		Default Fuel Use Factor:	0	gal/hp-hr		
Engine Heat Rating:	1.28	mmbtu/hr	Estimated Fuel Use Rate:	9.2	gal/hr		
Oil Btu Content:	5.838	mmbtu/bbl					
Annual Oil Usage:	11.40116	bbls/yr	Carbon Content:	19.95	kg/mmbtu		
	6.66E+01	mmbtu/yr	Frac Oxidized:	0.99			
Emissions Factors:			CO2/C Ratio:	3.6667			
CO2	73.96	kg/mmbtu or	Adjusted EF	72.4185	kg CO2/mmbtu		
CH4	0.003	kg/mmbtu					
N2O	0.0006	kg/mmbtu					

	kg/yr	**Emissions** metric tons/yr	IPCC GWP/SAR	CO2e metric tons/yr
CO2	4.82E+03	4.820175	1	4.820175
CH4	2.00E-01	0.0002	21	0.004193
N2O	3.99E-02	3.99E-05	310	0.01238

Total **4.8** **CO2e metric tons/yr**

5.3 CO2e short tons/yr

Source Specific Emissions Factor References, Data Notes, or Calculation Notes:
1. Default diesel fuel heat content = 139,000 btu/gal
2. Fuel use rate provided by mfg specification sheet, applicant, or see footnote 3.
3. Default fuel use factor from SCAQMD Rule 21 Staff Report, March 1995.
4. Ops data from PEP
5. EF Ref: FR 74, #209, Part 98 Subpart C, 10-30-2009, Pg. 56409-56411, Table C-1 and C-2.

Table A-7 Natural Gas Analysis Data-Palmdale Project

month	Btu HHV	spec gvty	n2	co2	methane	ethane	propane	i-butane	n-butane	i-pentane	n-pentane	c6 plus
jan	1018	0.579	0.38	1.11	96.45	1.80	0.17	0.02	0.03	0.01	0.00	0.02
feb	1019	0.580	0.38	1.15	96.37	1.74	0.25	0.03	0.04	0.01	0.00	0.02
mar	1014	0.577	0.39	1.15	96.76	1.49	0.15	0.02	0.02	0.00	0.00	0.01
apr	1021	0.580	0.51	0.93	96.07	2.21	0.20	0.03	0.03	0.01	0.00	0.01
may	1017	0.581	0.67	1.07	95.70	2.36	0.22	0.03	0.03	0.01	0.00	0.01
jun	1034	0.585	0.33	0.87	94.81	3.47	0.20	0.03	0.03	0.00	0.00	0.01
jul	1033	0.585	0.34	0.91	95.01	3.45	0.23	0.03	0.03	0.00	0.00	0.01
aug	1033	0.585	0.32	0.92	94.90	3.65	0.17	0.02	0.02	0.00	0.00	0.01
sep	1034	0.586	0.33	0.91	94.75	3.80	0.17	0.01	0.01	0.00	0.00	0.01
oct	1035	0.587	0.34	0.93	94.71	3.75	0.22	0.02	0.02	0.00	0.00	0.01
nov	1036	0.587	0.33	0.95	94.54	3.96	0.18	0.02	0.02	0.00	0.00	0.00
dec	1035	0.589	0.40	1.07	94.23	4.06	0.20	0.02	0.02	0.00	0.00	0.01

HHV = 1024 btu/scf used for application analyses.

Table A-8 Low Sulfur Diesel Fuel Characteristics

Property	Typical Value
Aromatics, V%	20.9
Aromatics, Wt%	21.4
Sulfur, ppm	<= 15
PNA, Wt%	2.77
T10, deg C	199
T50, deg C	248
T90, deg C	317
Density, g/ml	0.8285
CA-Methane Min Limit %	88
CA-Ethane Max Limit %	6
CA-Propane Max Limit	3
HHV, btu/gallon	139,000
Ref: BP-ARCO	

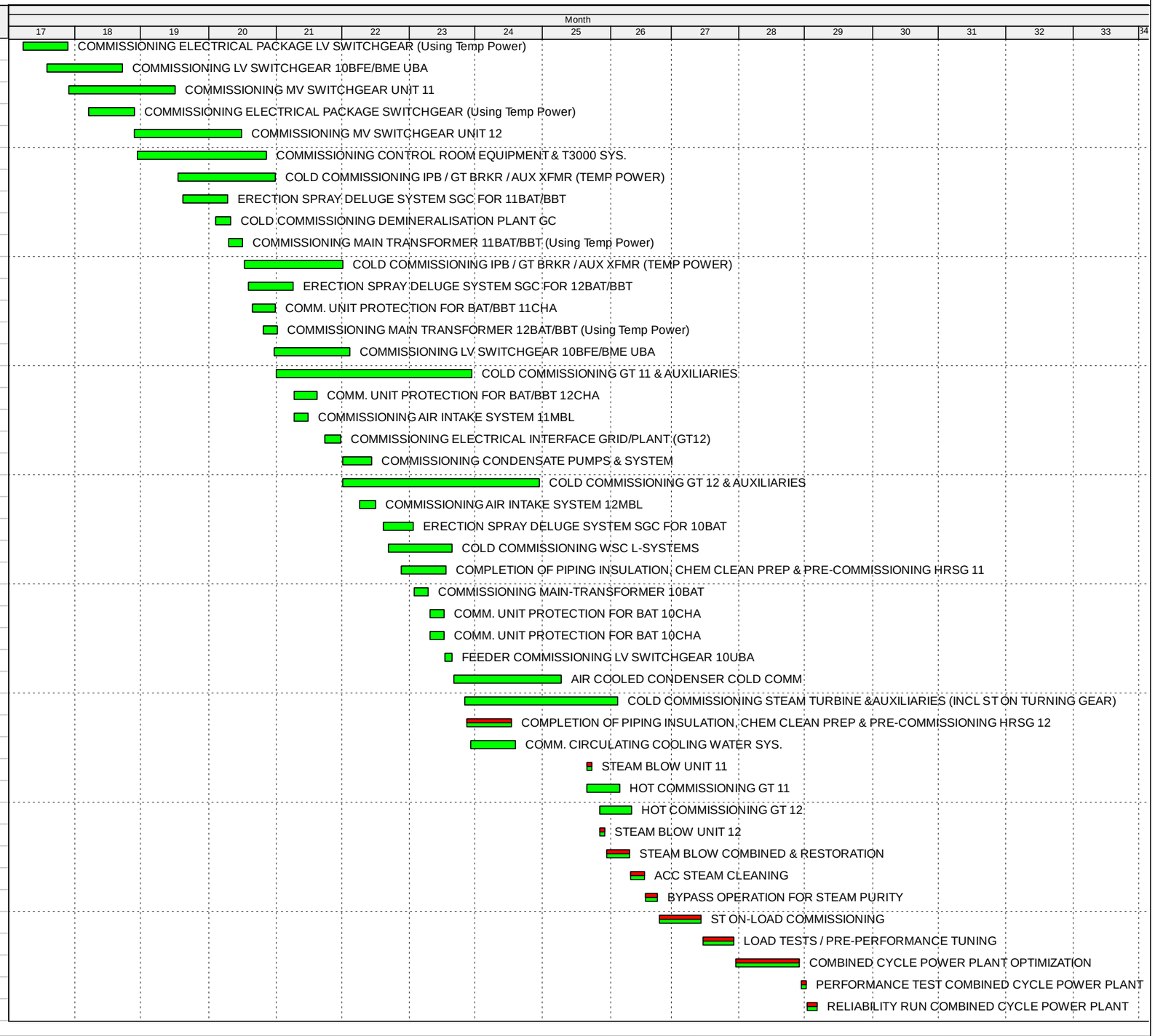
Commissioning Emissions Commissioning Phase	First Fire and Synch Checks	GT Emissions and Combustion Tuning	SCR Commissioning	CC Tuning & Testing	Total
SCR Installed	No	No	50%	Yes	
CO Catalyst Installed	No	No	Yes	Yes	
Hours per Unit	11	73	130	425	
# Units Operating Simultaneously *	1	1	1	2	
Avg Load %	0	50	75	100	
NOx lb/hr	122	132	54	29	
CO lb/hr	4500	796	194	123	
VOC lb/hr	516	90	22	16	
MMBtu/hr - HHV	696	1373	1945	2379	
NOx lb/mmscf	179	98	28	12	
CO lb/mmscf	6621	594	102	53	
VOC lb/mmscf	759	67	12	7	
Total NOx lbs (2 units)	**2,684**	**19,272**	**14,040**	**24,650**	**60,646**
Total CO lbs (2 units)	**99,000**	**116,216**	**50,440**	**104,550**	**370,206**
Total VOC lbs (2 units)	**11,352**	**13,140**	**5,720**	**13,600**	**43,812**

*Assume this number of units operate simultaneously at condition stated with the remaining units operating at fully commissioned full output

Nat. Gas MMBtu/mmscf	1024	<- Summit to amend	Siemens utilized fuel @ 23289 BTU/lb (HHV)
Number of GT Units	2		

Print Date: 13-Apr-15

Activity Name	OD
COMMISSIONING ELECTRICAL PACKAGE LV SWITCHGEAR (Using Temp Power)	21d
COMMISSIONING LV SWITCHGEAR 10BFE/BME UBA	35d
COMMISSIONING MV SWITCHGEAR UNIT 11	49d
COMMISSIONING ELECTRICAL PACKAGE SWITCHGEAR (Using Temp Power)	21d
COMMISSIONING MV SWITCHGEAR UNIT 12	49d
COMMISSIONING CONTROL ROOM EQUIPMENT & T3000 SYS.	60d
COLD COMMISSIONING IPB / GT BRKR / AUX XFMR (TEMP POWER)	45d
ERECTION SPRAY DELUGE SYSTEM SGC FOR 11BAT/BBT	21d
COLD COMMISSIONING DEMINERALISATION PLANT GC	7d
COMMISSIONING MAIN TRANSFORMER 11BAT/BBT (Using Temp Power)	7d
COLD COMMISSIONING IPB / GT BRKR / AUX XFMR (TEMP POWER)	45d
ERECTION SPRAY DELUGE SYSTEM SGC FOR 12BAT/BBT	21d
COMM. UNIT PROTECTION FOR BAT/BBT 11CHA	11d
COMMISSIONING MAIN TRANSFORMER 12BAT/BBT (Using Temp Power)	7d
COMMISSIONING LV SWITCHGEAR 10BFE/BME UBA	35d
COLD COMMISSIONING GT 11 & AUXILIARIES	90d
COMM. UNIT PROTECTION FOR BAT/BBT 12CHA	11d
COMMISSIONING AIR INTAKE SYSTEM 11MBL	7d
COMMISSIONING ELECTRICAL INTERFACE GRID/PLANT (GT12)	8d
COMMISSIONING CONDENSATE PUMPS & SYSTEM	14d
COLD COMMISSIONING GT 12 & AUXILIARIES	90d
COMMISSIONING AIR INTAKE SYSTEM 12MBL	7d
ERECTION SPRAY DELUGE SYSTEM SGC FOR 10BAT	14d
COLD COMMISSIONING WSC L-SYSTEMS	30d
COMPLETION OF PIPING INSULATION, CHEM CLEAN PREP & PRE-COMMISSIONING HRSG 11	21d
COMMISSIONING MAIN-TRANSFORMER 10BAT	7d
COMM. UNIT PROTECTION FOR BAT 10CHA	7d
COMM. UNIT PROTECTION FOR BAT 10CHA	7d
FEEDER COMMISSIONING LV SWITCHGEAR 10UBA	4d
AIR COOLED CONDENSER COLD COMM	49d
COLD COMMISSIONING STEAM TURBINE &AUXILIARIES (INCL ST ON TURNING GEAR)	70d
COMPLETION OF PIPING INSULATION, CHEM CLEAN PREP & PRE-COMMISSIONING HRSG 12	21d
COMM. CIRCULATING COOLING WATER SYS.	21d
STEAM BLOW UNIT 11	3d
HOT COMMISSIONING GT 11	15d
HOT COMMISSIONING GT 12	15d
STEAM BLOW UNIT 12	3d
STEAM BLOW COMBINED & RESTORATION	11d
ACC STEAM CLEANING	7d
BYPASS OPERATION FOR STEAM PURITY	6d
ST ON-LOAD COMMISSIONING	20d
LOAD TESTS / PRE-PERFORMANCE TUNING	15d
COMBINED CYCLE POWER PLANT OPTIMIZATION	30d
PERFORMANCE TEST COMBINED CYCLE POWER PLANT	3d
RELIABILITY RUN COMBINED CYCLE POWER PLANT	5d



Remaining Level of Effort
Remaining Work
Level of Effort
Current Bar
Start / Finish Milestone
Critical Remaining Work

SIEMENS ENERGY INC
SUMMIT PALMDALE 2X1 CC TK with ACC - Commissioning
Page 1 of 1

Layout: Commissioning
Project ID: RPPS-ZGK507-38

DRAFT

Table A -10 Fuel Use Calculations

Turbines with Duct Firing

Fuel Type:	Nat Gas	# of Turbines:	2	
Btu/scf, HHV:	1024	# of DBs:	2	
Btu/lb, HHV:	23289	Duct Firing:	1500	max hrs/yr
SCF/lb:	22.743	No duct firing:	6500	max hrs/yr (1)
		Max daily hrs:	24	

Firing Cases:

1	Case 2, Cold day 23F, Baseload, with duct firing
2	Case 11, ISO day 64F, Baseload, no duct firing
3	Case 12, ISO day, 64F, Baseload, with duct firing

Case 2 used to establish maximum hourly and daily fuel use values.
Cases 11 and 12 used to establish maximum annual fuel use values.

Fuel Use Values per Turbine/DB

Case	lbs/hr	scf/hr	scf/day	scf/yr	Est Annual Fuel Use, mmscf	
2	105,934.00	2,409,274.34	57,822,584.20	NA		
11	95,385.00	2,169,356.70	52,064,560.90	14,100,818,576.66		
12	103,463.00	2,353,075.98	56,473,823.60	3,529,613,975.10		
		mmscf/hr	**mmscf/day**	**mmscf/yr**		
2		2.4093	57.8226	NA		
11		2.1694	52.0646	14,100.82		
12		2.3531	56.4738	3,529.61	17,630.43	1 Unit
					35,260.87	2 Units

Turbines without Duct Firing

Fuel Type:	Nat Gas	# of Turbines:	2	
Btu/scf, HHV:	1024	# of DBs:	0	
Btu/lb, HHV:	23289	Duct Firing:	0	max hrs/yr
SCF/lb:	22.743	No duct firing:	6500	max hrs/yr (1)
		Max daily hrs:	24	

Firing Cases:

1	Case 1, Cold day 23F, Baseload, without duct firing
2	Case 11, ISO day 64F, Baseload, without duct firing

Case 2 used to establish maximum hourly and daily fuel use values.
Cases 11 used to establish maximum annual fuel use values.

Fuel Use Values per Turbine w/o DB

Case	lbs/hr	scf/hr	scf/day	scf/yr	Est Annual Fuel Use, mmscf	
2	97,636.00	2,220,551.57	53,293,237.59	NA		
11	95,385.00	2,169,356.70	52,064,560.90	14,100,818,576.66		
	0.00	0.00	0.00	0.00		
		mmscf/hr	**mmscf/day**	**mmscf/yr**		
2		2.2206	53.2932	NA		
11		2.1694	52.0646	14,100.82		
		0.0000	0.0000	0.00	14,100.82	1 Unit
					28,201.64	2 Units

SIEMENS

Summit - Palmdale

2x1 SCC6-5000F - Estimated Exhaust Stack Emissions
Combined Cycle / ULN Combustor

Estimated Emissions Data Sheet
April 22, 2015

SITE CONDITIONS:	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9	CASE 10	CASE 11	CASE 12	CASE 13	CASE 14	CASE 15	CASE 16	CASE 17	CASE 18	CASE 19	CASE 20	CASE 21	CASE 22	CASE 23	CASE 24	CASE 25	CASE 26	CASE 27	CASE 28	CASE 29
FUEL TYPE	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
GT LOAD LEVEL, %	100%	100%	75%	50%	100%	100%	100%	75%	50%	100%	100%	100%	75%	50%	100%	100%	100%	75%	50%	100%	100%	100%	75%	53%	40%	43%	43%	50%	100%
NET FUEL HEATING VALUE, Btu/lb$_m$ (LHV)	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981	20,981
GROSS FUEL HEATING VALUE, Btu/lb$_m$ (HHV)	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289	23,289
EVAPORATIVE COOLER STATUS	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
AMBIENT DRY BULB TEMPERATURE, °F	23	23	23	23	59	59	59	59	59	64	64	64	64	64	98	98	98	98	98	108	108	108	108	108	23	59	64	98	6
AMBIENT RELATIVE HUMIDITY, %	92	92	92	92	60	60	60	60	60	40	40	40	40	40	17	17	17	17	17	13	13	13	13	13	92	60	40	17	92
BAROMETRIC PRESSURE, psi$_a$	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416
DUCT BURNER STATUS	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON
LLCO STATUS	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	OFF
GT FUEL FLOW, lb$_m$/hr	97,636	97,643	78,674	60,929	94,584	95,400	95,413	75,804	58,765	93,633	95,385	95,389	75,068	58,250	83,549	93,180	93,176	68,358	53,474	80,056	92,091	92,082	65,603	53,277	53,921	53,502	53,440	53,343	98,855
DUCT BURNER FUEL FLOW, lb$_m$/hr	---	8,291	---	---	---	---	8,067	---	---	---	---	8,074	---	---	---	---	8,220	---	---	---	---	8,497	---	---	---	---	---	---	8,355
HRSG STACK EXHAUST GAS																													
EXHAUST FLOW, lb$_m$/hr	4,355,523	4,363,814	3,529,753	2,905,186	4,338,703	4,334,994	4,343,061	3,416,979	2,813,497	4,323,655	4,335,463	4,343,537	3,397,103	2,798,476	3,935,187	4,277,107	4,285,327	3,160,822	2,622,729	3,787,724	4,229,413	4,237,910	3,089,411	2,636,725	2,656,359	2,625,185	2,626,129	2,617,595	4,376,497
EXHAUST FLOW, acfm	1,337,241	1,322,717	1,075,349	875,178	1,332,969	1,333,585	1,321,663	1,029,786	842,800	1,327,666	1,334,691	1,323,975	1,022,155	836,978	1,222,268	1,346,870	1,335,763	967,113	792,896	1,182,441	1,344,061	1,333,863	951,970	803,665	797,863	784,928	784,096	791,270	1,326,115
STACK TEMPERATURE, °F	195	186	190	184	194	194	186	182	178	194	195	187	181	178	201	208	200	192	184	205	213	206	196	190	182	177	177	184	186
OXYGEN, Vol. %	12.28	11.59	12.41	12.98	12.39	12.27	11.59	12.33	12.89	12.49	12.28	11.60	12.40	12.96	12.60	12.21	11.52	12.53	13.07	12.63	12.17	11.45	12.67	13.12	13.26	13.10	13.15	13.07	11.54
CARBON DIOXIDE, Vol. %	3.92	4.23	3.86	3.60	3.80	3.84	4.14	3.83	3.58	3.78	3.83	4.14	3.82	3.57	3.71	3.79	4.10	3.74	3.50	3.69	3.78	4.11	3.67	3.47	3.48	3.48	3.48	3.49	4.28
WATER, Vol. %	8.13	8.76	8.02	7.50	8.58	8.89	9.50	8.64	8.14	8.32	8.85	9.45	8.40	7.90	8.42	9.59	10.21	8.48	8.00	8.42	9.82	10.47	8.38	7.98	7.25	7.95	7.73	7.99	8.63
NITROGEN, Vol. %	74.79	74.55	74.84	75.03	74.35	74.13	73.90	74.33	74.52	74.53	74.17	73.93	74.50	74.70	74.40	73.55	73.31	74.38	74.56	74.39	73.37	73.12	74.40	74.56	75.13	74.59	74.76	74.57	74.68
ARGON, Vol. %	0.88	0.87	0.88	0.88	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.88	0.87	0.86	0.86	0.87	0.87	0.87	0.86	0.86	0.87	0.87	0.88	0.87	0.88	0.87	0.88
MOLECULAR WEIGHT	28.43	28.38	28.43	28.47	28.37	28.34	28.29	28.36	28.40	28.39	28.34	28.29	28.39	28.42	28.38	28.26	28.21	28.37	28.40	28.38	28.23	28.18	28.38	28.40	28.48	28.41	28.43	28.40	28.40
HRSG STACK EMISSIONS (Based on USEPA Test Methods):																													
NO_X, ppmvd @ 15% O_2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NO_X, lb$_m$/hr as NO_2	17.1	18.5	13.6	10.5	16.5	16.7	18.1	13.1	10.1	16.4	16.7	18.1	13.0	10.0	14.6	16.3	17.7	11.9	9.2	14.0	16.1	17.6	11.4	9.2	9.2	9.2	9.2	9.2	18.8
NH_3, ppmvd @ 15% O_2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
NH_3, lb$_m$/hr	15.8	17.2	12.6	9.7	15.3	15.4	16.8	12.2	9.3	15.2	15.4	16.8	12.0	9.3	13.5	15.1	16.4	11.0	8.5	13.0	14.9	16.3	10.5	8.5	8.5	8.5	8.5	8.5	17.4
CO, ppmvd @ 15% O_2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO, lb$_m$/hr	10.4	11.3	8.3	6.4	10.1	10.2	11.0	8.0	6.2	10.0	10.2	11.0	7.9	6.1	8.9	9.9	10.8	7.2	5.6	8.5	9.8	10.7	6.9	5.6	5.6	5.6	5.6	5.6	11.4
VOC, ppmvd @ 15% O_2 as CH_4	1.0	2.2	1.0	1.0	1.0	1.0	2.2	1.0	1.0	1.0	1.0	2.2	1.0	1.0	1.0	1.0	2.2	1.0	1.0	1.0	1.0	2.2	1.0	1.0	1.0	1.0	1.0	1.0	2.2
VOC, lb$_m$/hr as CH_4	3.0	7.0	2.4	1.9	2.9	3.0	6.8	2.3	1.8	2.9	3.0	6.8	2.3	1.8	2.6	2.9	6.8	2.1	1.6	2.5	2.8	6.9	2.0	1.6	1.6	1.6	1.6	1.6	7.1
SO_2, lb$_m$/hr	1.4	1.5	1.1	0.9	1.4	1.4	1.5	1.1	0.9	1.4	1.4	1.5	1.1	0.9	1.2	1.3	1.5	1.0	0.8	1.2	1.3	1.4	1.0	0.8	0.8	0.8	0.8	0.8	1.5
PARTICULATES, lb$_m$/hr	9.8	11.8	8.0	8.0	9.7	9.7	11.7	8.0	8.0	9.7	9.7	11.7	8.0	8.0	8.8	9.5	11.5	8.0	8.0	8.5	9.4	11.5	8.0	8.0	8.0	8.0	8.0	8.0	11.9
CO_2, lb$_m$/hr	272,172	295,148	217,149	166,627	263,683	265,996	288,350	209,267	160,745	261,056	265,923	288,296	207,265	159,305	233,000	259,781	282,556	188,735	146,312	223,269	256,744	280,284	181,183	145,935	146,955	145,967	145,827	145,914	298,701

NOTES:

- All data is ESTIMATED, NOT guaranteed and is for ONE unit.
- Gas fuel composition (mole percent) is: 98% CH_4, 0.6% C_2H_6, 1.4% N_2, and ~ 0.2 grains/100 SCF of sulfur.
- Gas fuel must be in compliance with the Siemens Gas Fuel Specification.
- NO_X and CO assume the use of an SCR and oxidation catalyst, respectively.
- VOC consist of total hydrocarbons excluding methane and ethane and are expressed in terms of methane (CH_4).
- Particulates are per US EPA Method 5 and 202 (front and back half).
- Emissions exclude ambient air contributions and assume steady-state conditions.
- Please be advised that the information contained in this transmittal has been prepared and is being transmitted per customer request specifically for information purposes only.
  Data included in any permit application or Environmental Impact Statement are strictly the customer's responsibility. Siemens is available to review permit application data upon request.

ATTACHMENT A-1 TURBINE RUN CASE DATA

SIEMENS

Summit Palmdale
SCC6-5000F 2x1 ACC - Turnkey

Performance Estimate Data Sheet

April 17, 2015

BASE REFERENCE CONDITIONS

		Case 01	Case 02	Case 03	Case 04	Case 05	Case 06	Case 07	Case 08	Case 09	Case 10	Case 11	Case 12	Case 13	Case 14	Case 15	Case 16	Case 17
GT Load Level	%	Base Load	Base Load	75	50	Base Load	Base Load	Base Load	75	50	Base Load	Base Load	Base Load	75	50	Base Load	Base Load	Base Load
Plant Configuration	-	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1
Plant Equipment Condition	-	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean
Inlet Temperature	°F	23.0	23.0	23.0	23.0	59.0	59.0	59.0	59.0	59.0	64.0	64.0	64.0	64.0	64.0	98.0	98.0	98.0
Relative Humidity	%	92.0	92.0	92.0	92.0	60.0	60.0	60.0	60.0	60.0	40.0	40.0	40.0	40.0	40.0	17.0	17.0	17.0
Barometric Pressure	psia	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416
Fuel Type	-	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas
Fuel Heating Value – (LHV)	Btu/lbm	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981
Fuel Composition	-	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]
Fuel Temperature at Test Boundary	°F	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Power Factor @ Generator Terminals	-	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
System Frequency	Hz	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
HRSG Blowdown	%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evap Cooler Status	-	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON	ON
Duct Burner Status	-	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON

ESTIMATED PERFORMANCE

Net Power	kW	669,600	714,400	516,600	370,500	650,200	656,400	699,400	503,000	361,700	643,600	656,300	699,400	498,100	358,300	566,400	633,600	677,100
Net Heat Rate	Btu/kWhr LHV	6,120	6,230	6,390	6,910	6,110	6,100	6,210	6,330	6,820	6,110	6,100	6,210	6,330	6,820	6,190	6,180	6,290
Gross GT Power	kW	457,300	457,400	343,000	228,700	434,300	440,800	440,800	325,700	217,200	428,500	440,700	440,700	321,400	214,200	371,800	424,900	424,900
Gross ST Power	kW	229,100	274,600	189,300	156,500	232,600	232,300	276,100	192,900	159,200	231,800	232,300	276,200	192,400	158,800	210,800	225,300	269,600
Aux Loads	kW	16,800	17,600	15,700	14,700	16,700	16,700	17,500	15,600	14,700	16,700	16,700	17,500	15,700	14,700	16,200	16,600	17,400

NOTES:

1 The performance data provided is estimated and not guaranteed.

2 The Net Power is defined as the power as determined at the high side terminals of the generator step up transformer. Net Power is determined by measuring gross power at the generator terminals minus auxiliary loads consumed by the Siemens supplied auxiliary equipment which support operation of the facility.

3 Net Heat Rate is the fuel input rate to the gas turbines and duct burners in Btu/hr on a lower heating value (LHV) basis, divided by the Net Power in kW.

4 The performance data is based on new and clean conditions and the application of a test tolerance equal to test uncertainty.

5 Gas fuel must comply with Siemens Gas Fuel Specification ZDX555-DC01-MBP-2500-01.

6 The fuel gas composition used in the performance estimate is (Mol %) 98.0000% Methane, 0.6000% Ethane, 1.4000% Nitrogen, and assumes less than 0.20 grains of sulfur per 100 SCF

Attachment A-1 Part 2 (2 pages)

SIEMENS

Summit Palmdale
SCC6-5000F 2x1 ACC - Turnkey

Performance Estimate Data Sheet

April 17, 2015

BASE REFERENCE CONDITIONS

		Case 18	Case 19	Case 20	Case 21	Case 22	Case 23	Case 24	Case 25	Case 26	Case 27	Case 28	Case 29
GT Load Level	%	75	50	Base Load	Base Load	Base Load	75	MECL	MECL	MECL	MECL	MECL	Base Load
Plant Configuration	-	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1	2x1
Plant Equipment Condition	-	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean	New and Clean
Inlet Temperature	°F	98.0	98.0	108.0	108.0	108.0	108.0	108.0	23.0	59.0	64.0	98.0	6.0
Relative Humidity	%	17.0	17.0	13.0	13.0	13.0	13.0	13.0	92.0	60.0	40.0	17.0	92.0
Barometric Pressure	psia	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416	13.416
Fuel Type	-	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas
Fuel Heating Value – (LHV)	Btu/lbm	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981	20981
Fuel Composition	-	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]	See note [5&6]
Fuel Temperature at Test Boundary	°F	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Power Factor @ Generator Terminals	-	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
System Frequency	Hz	60	60	60	60	60	60	60	60	60	60	60	60
HRSG Blowdown	%	0	0	0	0	0	0	0	0	0	0	0	0
Evap Cooler Status	-	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	-	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON

ESTIMATED PERFORMANCE

Net Power	kW	440,500	317,900	533,800	620,000	664,300	414,600	313,200	312,700	318,800	319,300	316,700	719,800
Net Heat Rate	Btu/kWhr LHV	6,520	7,060	6,300	6,240	6,360	6,640	7,140	7,240	7,050	7,030	7,070	6,250
Gross GT Power	kW	278,800	185,900	349,500	419,300	419,200	262,100	185,000	185,000	185,000	185,000	185,000	463,200
Gross ST Power	kW	176,900	146,400	200,200	217,300	262,400	167,500	142,600	142,000	148,200	148,700	146,100	274,200
Aux Loads	kW	15,200	14,400	15,900	16,600	17,300	15,000	14,400	14,300	14,400	14,400	14,400	17,600

NOTES:

1 The performance data provided is estimated and not guaranteed.

2 The Net Power is defined as the power as determined at the high side terminals of the generator step up transformer. Net Power is determined by measuring gross power at the generator terminals minus auxiliary loads consumed by the Siemens supplied auxiliary equipment which support operation of the facility.

3 Net Heat Rate is the fuel input rate to the gas turbines and duct burners in Btu/hr on a lower heating value (LHV) basis, divided by the Net Power in kW.

4 The performance data is based on new and clean conditions and the application of a test tolerance equal to test uncertainty.

5 Gas fuel must comply with Siemens Gas Fuel Specification ZDX555-DC01-MBP-2500-01.

6 The fuel gas composition used in the performance estimate is (Mol %) 98.0000% Methane, 0.6000% Ethane, 1.4000% Nitrogen, and assumes less than 0.20 grains of sulfur per 100 SCF

PERFORMANCE DATA[DM8761]

May 29, 2012

Performance Number: DM8761 **Change Level: 03**

SALES MODEL:	3512C	**COMBUSTION:**	DI
ENGINE POWER (BHP):	1,853	**ENGINE SPEED (RPM):**	1,800
GEN POWER WITH FAN (EKW):	1,250.0	**HERTZ:**	60
COMPRESSION RATIO:	14.7	**FAN POWER (HP):**	88.5
APPLICATION:	PACKAGED GENSET	**ASPIRATION:**	TA
RATING LEVEL:	STANDBY	**AFTERCOOLER TYPE:**	ATAAC
PUMP QUANTITY:	1	**AFTERCOOLER CIRCUIT TYPE:**	JW+OC, ATAAC
FUEL TYPE:	DIESEL	**INLET MANIFOLD AIR TEMP (F):**	114
MANIFOLD TYPE:	DRY	**JACKET WATER TEMP (F):**	210.2
GOVERNOR TYPE:	ADEM3	**TURBO CONFIGURATION:**	PARALLEL
ELECTRONICS TYPE:	ADEM3	**TURBO QUANTITY:**	4
CAMSHAFT TYPE:	STANDARD	**TURBOCHARGER MODEL:**	GTB4708BN-52T-0.96
IGNITION TYPE:	CI	**CERTIFICATION YEAR:**	2009
INJECTOR TYPE:	EUI	**PISTON SPD @ RATED ENG SPD (FT/MIN):**	2,244.1
FUEL INJECTOR:	2664387		
REF EXH STACK DIAMETER (IN):	10		
MAX OPERATING ALTITUDE (FT):	6,562		

General Performance Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	BRAKE MEAN EFF PRES (BMEP)	BRAKE SPEC FUEL CONSUMPTN (BSFC)	VOL FUEL CONSUMPTN (VFC)	INLET MFLD PRES	INLET MFLD TEMP	EXH MFLD TEMP	EXH MFLD PRES	ENGINE OUTLET TEMP
EKW	%	BHP	PSI	LB/BHP-HR	GAL/HR	IN-HG	DEG F	DEG F	IN-HG	DEG F
1,250.0	100	1,853	258	0.341	90.1	69.3	114.5	1,082.4	65.6	715.7
1,125.0	90	1,677	234	0.345	82.7	64.0	111.7	1,054.7	60.0	701.7
1,000.0	80	1,500	209	0.349	74.9	57.5	109.0	1,026.0	53.7	690.2
937.5	75	1,412	197	0.351	70.8	53.8	107.8	1,011.2	50.2	685.5
875.0	70	1,324	184	0.353	66.7	49.9	107.0	996.2	46.5	682.0
750.0	60	1,147	160	0.355	58.2	40.8	107.5	964.3	38.5	686.3
625.0	50	971	135	0.358	49.7	31.6	108.3	928.4	30.7	686.8
500.0	40	794	111	0.364	41.3	23.3	107.7	878.9	23.9	675.6
375.0	30	618	86	0.377	33.3	16.4	106.1	802.6	18.4	644.9
312.5	25	530	74	0.387	29.3	13.4	105.3	756.0	16.1	621.9
250.0	20	441	61	0.403	25.4	10.6	104.4	703.7	14.0	593.7
125.0	10	265	37	0.468	17.7	6.3	102.8	572.2	10.6	497.4

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	COMPRESSOR OUTLET PRES	COMPRESSOR OUTLET TEMP	WET INLET AIR VOL FLOW RATE	ENGINE OUTLET WET EXH GAS VOL FLOW RATE	WET INLET AIR MASS FLOW RATE	WET EXH GAS MASS FLOW RATE	WET EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)	DRY EXH VOL FLOW RATE (32 DEG F AND 29.98 IN HG)
EKW	%	BHP	IN-HG	DEG F	CFM	CFM	LB/HR	LB/HR	FT3/MIN	FT3/MIN
1,250.0	100	1,853	74	417.6	4,277.1	9,808.5	18,861.2	19,492.2	4,102.9	3,733.7
1,125.0	90	1,677	68	398.5	4,081.9	9,211.1	17,949.9	18,528.9	3,899.6	3,557.0
1,000.0	80	1,500	62	374.5	3,832.1	8,521.5	16,789.5	17,313.6	3,643.7	3,329.8
937.5	75	1,412	58	360.8	3,687.5	8,145.0	16,120.5	16,616.3	3,497.0	3,198.2
875.0	70	1,324	54	345.8	3,527.7	7,745.8	15,384.7	15,851.6	3,335.8	3,052.7
750.0	60	1,147	44	310.6	3,140.0	6,873.7	13,642.6	14,050.1	2,949.1	2,700.5
625.0	50	971	34	273.1	2,737.8	5,975.5	11,849.5	12,197.2	2,562.6	2,349.1
500.0	40	794	26	236.3	2,366.0	5,105.5	10,205.3	10,494.6	2,211.1	2,031.3
375.0	30	618	19	201.6	2,047.8	4,290.5	8,810.7	9,043.5	1,909.9	1,761.8
312.5	25	530	16	184.7	1,905.8	3,899.6	8,192.6	8,397.6	1,772.8	1,639.8
250.0	20	441	13	168.3	1,775.2	3,520.0	7,627.9	7,805.5	1,642.9	1,524.7
125.0	10	265	8	142.5	1,585.3	2,839.9	6,801.3	6,925.3	1,458.9	1,367.6

Heat Rejection Data

GENSET POWER WITH FAN	PERCENT LOAD	ENGINE POWER	REJECTION TO JACKET WATER	REJECTION TO ATMOSPHERE	REJECTION TO EXH	EXHUAST RECOVERY TO 350F	FROM OIL COOLER	FROM AFTERCOOLER	WORK ENERGY	LOW HEAT VALUE ENERGY	HIGH HEAT VALUE ENERGY
EKW	%	BHP	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN	BTU/MIN
1,250.0	100	1,853	31,576	6,514	65,110	29,759	10,304	23,510	78,581	193,456	206,079
1,125.0	90	1,677	29,734	6,270	60,204	27,143	9,452	21,032	71,098	177,455	189,034
1,000.0	80	1,500	27,726	6,037	54,953	24,489	8,557	18,207	63,615	160,654	171,136
937.5	75	1,412	26,663	5,923	52,223	23,157	8,095	16,680	59,874	151,991	161,909
875.0	70	1,324	25,559	5,808	49,422	21,848	7,624	15,063	56,133	143,145	152,486
750.0	60	1,147	23,229	5,569	43,689	19,616	6,655	11,479	48,650	124,950	133,103
625.0	50	971	20,792	5,328	37,871	17,045	5,680	8,052	41,167	106,635	113,593
500.0	40	794	18,283	4,989	31,968	14,150	4,726	5,314	33,685	88,727	94,517
375.0	30	618	15,693	4,533	26,028	10,994	3,802	3,354	26,202	71,391	76,049
312.5	25	530	14,356	4,306	23,064	9,385	3,349	2,590	22,460	62,878	66,981
250.0	20	441	12,992	4,089	20,111	7,793	2,901	1,968	18,719	54,468	58,022
125.0	10	265	10,085	3,727	14,275	4,131	2,024	1,065	11,236	37,992	40,472

Regulatory Information

EPA TIER 2		2006 - 2010		
GASEOUS EMISSIONS DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 89 SUBPART D AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. GASEOUS EMISSIONS VALUES ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE NON-ROAD REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	NON-ROAD	TIER 2	CO: 3.5 NOx + HC: 6.4 PM: 0.20

EPA EMERGENCY STATIONARY		2011 - ----		
GASEOUS EMISSIONS DATA MEASUREMENTS ARE CONSISTENT WITH THOSE DESCRIBED IN EPA 40 CFR PART 60 SUBPART IIII AND ISO 8178 FOR MEASURING HC, CO, PM, AND NOX. GASEOUS EMISSIONS LIMIT VALUES ARE WEIGHTED CYCLE AVERAGES AND ARE IN COMPLIANCE WITH THE NON-ROAD REGULATIONS.				
Locality	**Agency**	**Regulation**	**Tier/Stage**	**Max Limits - G/BKW - HR**
U.S. (INCL CALIF)	EPA	STATIONARY	EMERGENCY STATIONARY	CO: 3.5 NOx + HC: 6.4 PM: 0.20

Altitude Derate Data

ALTITUDE CORRECTED POWER CAPABILITY (BHP)

AMBIENT OPERATING TEMP (F)	50	60	70	80	90	100	110	120	130	NORMAL
ALTITUDE (FT)										
0	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853
1,000	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853
2,000	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853
3,000	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853
4,000	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853
5,000	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,853	1,825	1,853
6,000	1,853	1,853	1,853	1,853	1,853	1,848	1,815	1,784	1,754	1,853
7,000	1,853	1,853	1,853	1,841	1,807	1,775	1,744	1,714	1,685	1,853
8,000	1,853	1,836	1,801	1,767	1,735	1,704	1,674	1,646	1,618	1,853
9,000	1,796	1,762	1,728	1,696	1,666	1,636	1,607	1,579	1,553	1,809
10,000	1,723	1,690	1,658	1,628	1,598	1,569	1,542	1,515	1,490	1,748
11,000	1,653	1,621	1,590	1,561	1,532	1,505	1,479	1,453	1,429	1,688
12,000	1,584	1,554	1,524	1,496	1,469	1,443	1,417	1,393	1,369	1,630
13,000	1,518	1,489	1,461	1,434	1,408	1,382	1,358	1,335	1,312	1,573
14,000	1,454	1,426	1,399	1,373	1,348	1,324	1,301	1,278	1,257	1,517
15,000	1,392	1,365	1,339	1,314	1,290	1,267	1,245	1,224	1,203	1,463

Performance Parameter Reference

Parameters Reference:DM9600-05

PERFORMANCE DEFINITIONS

PERFORMANCE DEFINITIONS DM9600

APPLICATION:
Engine performance tolerance values below are representative of a typical production engine tested in a calibrated dynamometer test cell at SAE J1995 standard reference conditions. Caterpillar maintains ISO9001:2000 certified quality management systems for engine test Facilities to assure accurate calibration of test equipment. Engine test data is corrected in accordance with SAE J1995. Additional reference material SAE J1228, J1349, ISO 8665, 3046-1:2002E, 3046-3:1989, 1585, 2534, 2288, and 9249 may apply in part or are similar to SAE J1995. Special engine rating request(SERR)test data shall be noted.

PERFORMANCE PARAMETER TOLERANCE FACTORS:

Power	+/- 3%
Torque	+/- 3%
Exhaust stack temperature	+/- 8%
Inlet airflow	+/- 5%
Intake manifold pressure-gage	+/- 10%
Exhaust flow	+/- 6%
Specific fuel consumption	+/- 3%
Fuel rate	+/- 5%
Heat rejection	+/- 5%
Heat rejection exhaust only	+/- 10%

Torque is included for truck and industrial applications, do not use for Gen Set or steady state applications.

On C7 - C18 engines, at speeds of 1100 RPM and under these values are provided for reference only, and may not meet the tolerance listed.

These values do not apply to C280/3600. For these models, see the tolerances listed below.

C280/3600 HEAT REJECTION TOLERANCE FACTORS:

Heat rejection	+/- 10%
Heat rejection to Atmosphere	+/- 50%
Heat rejection to Lube Oil	+/- 20%
Heat rejection to Aftercooler	+/- 5%

TEST CELL TRANSDUCER TOLERANCE FACTORS:

Torque	+/- 0.5%
Speed	+/- 0.2%
Fuel flow	+/- 1.0%
Temperature	+/- 2.0 C degrees
Intake manifold pressure	+/- 0.1 kPa

OBSERVED ENGINE PERFORMANCE IS CORRECTED TO SAE J1995 REFERENCE AIR AND FUEL CONDITIONS.

REFERENCE ATMOSPHERIC INLET AIR

FOR 3500 ENGINES AND SMALLER
SAE J1228 reference atmospheric pressure is 100 KPA (29.61 in hg) and standard temperature is 25 (77) at 60% relative humidity.

FOR 3600 ENGINES
Engine rating obtained and presented in accordance with ISO 3046/1 and SAE J1995 JAN90 standard reference conditions of 25, 100 KPA 30% relative humidity and 150M altitude at the stated aftercooler water temperature.

MEASUREMENT LOCATION FOR INLET AIR TEMPERATURE
Location for air temperature measurement air cleaner inlet at stabilized operating conditions.

PERFORMANCE DATA[DM8761]

REFERENCE EXHAUST STACK DIAMETER
The Reference Exhaust Stack Diameter published with this dataset is only used for the calculation of Smoke Opacity values displayed in this dataset. This value does not necessarily represent the actual stack diameter of the engine due to the variety of exhaust stack adapter options available. Consult the price list, engine order or general dimension drawings for the actual stack diameter size ordered or options available.

REFERENCE FUEL

DIESEL
Reference fuel is #2 distillate diesel with a 35API gravity;
A lower heating value is 42,780 KJ/KG (18,390 BTU/LB) when used at 29 (84.2), where the density is 838.9 G/Liter (7.001 Lbs/Gal).

GAS
Reference natural gas fuel has a lower heating value of 33.74 KJ/L (905 BTU/CU Ft). Low BTU ratings are based on 18.64 KJ/L (500 BTU/CU FT) lower heating value gas. Propane ratings are based on 87.56 KJ/L (2350 BTU/CU Ft) lower heating value gas.

ENGINE POWER (NET) IS THE CORRECTED FLYWHEEL POWER (GROSS) LESS EXTERNAL AUXILIARY LOAD
Engine corrected gross output includes the power required to drive standard equipment; lube oil, scavenge lube oil, fuel transfer, common rail fuel, separate circuit aftercooler and jacket water pumps. Engine net power available for the external (flywheel) load is calculated by subtracting the sum of auxiliary load from the corrected gross flywheel out put power. Typical auxiliary loads are radiator cooling fans, hydraulic pumps, air compressors and battery charging alternators.

ALTITUDE CAPABILITY
Altitude capability is the maximum altitude above sea level at standar d temperature and standard pressure at which the engine could develop full rated output power on the current performance data set. Standard temperature values versus altitude could be seen on TM2001.

Engines with ADEM MEUI and HEUI fuel systems operating at conditions above the defined altitude capability derate for atmospheric pressure and temperature conditions outside the values defined, see TM2001. Mechanical governor controlled unit injector engines require a setting change for operation at conditions above the altitude defined on the engine performance sheet. See your Caterpillar technical representative for non standard ratings.

REGULATIONS AND PRODUCT COMPLIANCE
TMI Emissions information is presented at 'nominal' and 'not to exceed' values for standard ratings. No tolerances are applied to the emissions data. These values are subject to change at any time. The controlling federal and local emission requirements need to be verified by your Caterpillar technical representative. Log on to the Technology and Solutions Divisions (T&SD) web page (http://tsd.cat.com/etsd/index.cfm?tech_id=2635ICAL) for information including federal regulation applicability and time lines for implementation. Information for labeling and tagging requirements is also provided.

NOTES:
Regulation watch covers regulations in effect and future regulation ch anges for world, federal, state and loca. This page includes items on the watch list where a regulation change or product change might be pending and may need attention of the engine product group. For additional emissions information log on to the TMI web page.

Additional product information for specific market application is available.
Customer's may have special emission site requirements that need to be verified by the Caterpillar Product Group engineer.

HEAT REJECTION DEFINITIONS:
Diesel Circuit Type and HHV Balance : DM9500

EMISSIONS DEFINITIONS:
Emissions : DM1176

SOUND DEFINITIONS:

CLARKE®

FIRE PUMP ENGINES

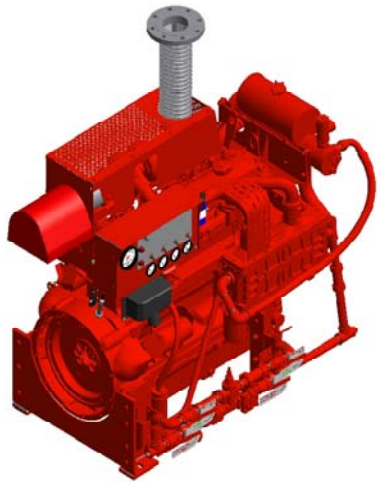
MODELS

JU6H-UFD0 JU6H-UFD2 JU6H-UF30 JU6H-UF32 JU6H-UF34 JU6H-UFM8 JU6H-UFM0 JU6H-UFM2 JU6H-UF58 JU6H-UF50 JU6H-UF52 JU6H-UF54 JU6H-UF60 JU6H-UF62 JU6H-UFAAQ8 JU6H-UFAAPG JU6H-UFAARG JU6H-UF84 JU6H-UFAAS0

FM-UL-cUL APPROVED RATINGS BHP/*KW*

Attachment A-2 Part 2

JU6H MODEL ♦	RATED SPEED 1470		1760		2100		2350		2600		2800		3000		US-EPA (NSPS) Available Until ●
UFD0			110	*82*	144	*107*	148	*110*							*12/31/09*
UFD2							148	*110*	148	*110*					*12/31/09*
UF30	94	*70*	140	*104*	160	*119*	160	*119*							*12/31/09*
UF32							160	*119*	160	*119*					*12/31/09*
UF34											160	*119*	175	*131*	*12/31/11 ▲ 12/31/12 ▼+*
UFM8	136	*101*	175	*131*											*12/31/09*
UFM0			175	*131*	207	*154*	200	*149*							*12/31/08*
UFM2							200	*149*	200	*149*					*12/31/08*
UF58	138	*103*	183	*137*											*12/31/08*
UF50			183	*137*	210	*157*	210	*157*							*12/31/08*
UF52							210	*157*	210	*157*					*12/31/08*
UF54											216	*161*	216	*161*	*12/31/11*
UFAAPG	220	*164*													*N/A λ*
UFAAQ8			227	*169*											*N/A λ*
UF60			200	*149*	240	*179*	240	*179*							*12/31/08*
UF62							240	*179*	240	*179*					*12/31/08*
UFAARG			252	*188*											*N/A λ*
UF84											259	*193*	275	*205*	*12/31/11*
UFAAS0					260	*194*									*N/A λ*



Picture shown represents TRWA engine model

● USA EPA (NSPS) Emissions Compliant. Applies to John Deere model year per Table 4 of 40 CFR Part 60 Sub Part IIII.

♦ All Models are available for Export

λ N/A = Not Applicable / Non-Emissionized

\+ Not Available in California

▼ Less than 175 HP

▲ Greater than 174 HP

SPECIFICATIONS

ITEM	JU6H MODELS D0 D2 30 32 34 M8 M0 M2 58 50 52 54	60 62 AAQ8 PG AARG/S0 84
Number of Cylinders	6	
Aspiration	T	TRWA
Rotation*	CW	
Overall Dimensions – in. (mm)	57 (1458) L x 37 (931) W x 46" (1164) H	58 (1474) L x 37 (931) W x 46" (1164) H
Crankshaft Centerline Height - in. (mm)	14 (356)	
Weight – lb (kg)	1657 (750)	1693 (766)
Compression Ratio	17.0:1	
Displacement – cu. in. (L)	414 (6.8)	
Engine Type	4 Stroke Cycle – Inline Construction	
Bore & Stroke – in. (mm)	4.19 x 5.00 (106 x 127)	
Installation Drawing	D536	
Wiring Diagram AC	C07591	
Wiring Diagram DC	C071612	
Engine Series	John Deere 6068 Series	
Speed Interpolation	Optional	

Abbreviations: CW – Clockwise T – Turbocharged TRWA – Turbocharged with Raw Water Aftercooling L - Length W – Width H - Height

*Rotation viewed from Heat Exchanger / Front of engine

CERTIFIED POWER RATING

- Each engine is factory tested to verify power and performance.
- Although FM-UL ratings are shown at specific speeds, Clarke engines can be applied at any intermediate speed. To determine the intermediate speed power; make a linear interpolation from the Clarke FM-UL power curve. Contact Clarke or your Pump OEM Representative to obtain details.

c UL us

Meets NFPA 20 Requirements

FM C US APPROVED

ENGINE RATINGS BASELINES

- Engines are to be used for stationary emergency standby fire pump service only. Engines are to be tested in accordance with NFPA 25.
- Engines are rated at standard SAE conditions of 29.61 in. (752.1 mm) Hg barometer and 77°F (25°C) inlet air temperature [approximates 300 ft. (91.4 m) above sea level] by the testing laboratory (see SAE Standard J 1349).
- A deduction of 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft. (305 m) altitude above 300 ft. (91.4 m)
- A deduction of 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 77°F (25°C) ambient temperature.

CLARKE®

FIRE PUMP ENGINES

MODELS

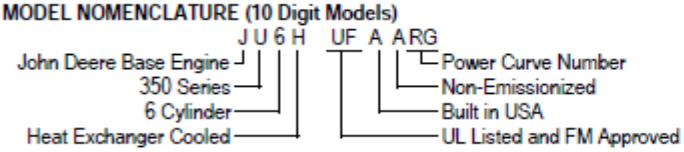
JU6H-UFD0	JU6H-UF32	JU6H-UFM2	JU6H-UF54	JU6H-UFAAPG
JU6H-UFD2	JU6H-UF34	JU6H-UF58	JU6H-UF60	JU6H-UFAARG
JU6H-UF30	JU6H-UFM8	JU6H-UF50	JU6H-UF62	JU6H-UF84
	JU6H-UFM0	JU6H-UF52	JU6H-UFAAQ8	JU6H-UFAAS0

ENGINE EQUIPMENT

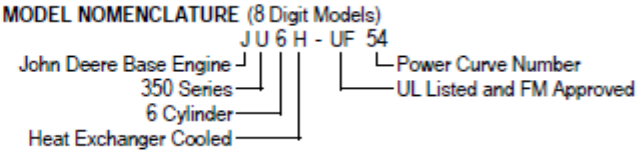
EQUIPMENT	STANDARD	OPTIONAL
Air Cleaner	Direct Mounted, Washable, Indoor Service with Drip Shield	Disposable, Drip Proof, Indoor Service Outdoor Type, Single or Two Stage (Cyclonic)
Alarms	Overspeed Alarm & Shutdown, Low Oil Pressure, Low & High Coolant Temperature, Low Raw Water Flow, High Raw Water Temperature	
Alternator	12V-DC, 42 Amps with Poly-Vee Belt and Guard	24V-DC, 40 Amps with Poly-Vee Belt and Guard
Coupling	Bare Flywheel	Listed Driveshaft and Guard, UFD0/D2/30/32/34 – CDS20-S1; UFM8/M0/M2/58/50/52/54/60/62/84 – CDS30-S1; AAPG/AAQ8/AARG/AAS0 – CDS50-SC
Exhaust Flex Connection	Stainless Steel Flex, 150# ANSI Flanged Connection, 5”	Stainless Steel Flex, 150# ANSI Flanged Connection, 6”
Exhaust Protection	Metal Guards on Manifolds and Turbocharger	
Flywheel Housing	SAE #3	
Flywheel Power Take Off	11.5” SAE Industrial Flywheel Connection	
Fuel Connections	Fire Resistant, Flexible, USA Coast Guard Approved, Supply and Return Lines	Stainless Steel, Braided, cUL Listed, Supply and Return Lines
Fuel Filter	Primary Filter with Priming Pump	
Fuel Injection System	Stanadyne, Direct Injection	
Engine Heater	115V-AC, 1360 Watt	230V-AC, 1360 Watt
Governor, Speed	Constant Speed, Mechanical	
Heat Exchanger	Tube and Shell Type, 60 PSI (4 BAR), NPT(F) Connections – Sea Water Compatible	
Instrument Panel	English and Metric, Tachometer, Hourmeter, Water Temperature, Oil Pressure and Two (2) Voltmeters	
Junction Box	Integral with Instrument Panel; For DC Wiring Interconnection to Engine Controller	
Lube Oil Cooler	Engine Water Cooled, Plate Type	
Lube Oil Filter	Full Flow with By-Pass Valve	
Lube Oil Pump	Gear Driven, Gear Type	
Manual Start Control	On Instrument Panel with Control Position Warning Light	
Overspeed Control	Electronic with Reset and Test on Instrument Panel	
Run – Stop Control	On Instrument Panel with Control Position Warning Light	
Raw Water Cooling Loop – w\Alarms	Galvanized	Seawater, All 316SS, High Pressure
Raw Water Cooling Loop – Solenoid Operation	Automatic from Fire Pump Controller and from Engine Instrument Panel (for Horizontal Fire Pump Applications)	Not Supplied (for Vertical Turbine Fire Pump Applications)
Run Solenoid	12V-DC Energized to Stop (ETS)	12V-DC Energized to Run (ETR); 24V-DC Energized to Run (ETR); 24V-DC Energized to Stop (ETS)
Starters	Two (2) 12V-DC	Two (2) 24V-DC
Throttle Control	Adjustable Speed Control, Tamper Proof	
Water Pump	Centrifugal Type, Poly-Vee Belt Drive with Guard	

Abbreviations :DC – Direct Current, AC – Alternating Current, SAE – Society of Automotive Engineers, NPT(F) – National Pipe Tapered Thread (Female) SS – Stainless Steel

MODEL NOMENCLATURE (10 Digit Models)



MODEL NOMENCLATURE (8 Digit Models)



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C13556 revP
23FEB15

BOILER PREDICTED PERFORMANCE*

Version: NB-Size-2014.0.1 **Customer:** Siemens **Engineer:** Skiles
Proposal: TBD **Fuel:** Birmingham
Model: NB-300D-65 **Design Pressure:** 250 PSIG
June 1, 2015

Boiler load - %	**100%**	**75%**	**50%**	**25%**							
Steam Flow - Gross Production	70,000	52,500	35,000	17,500							Lb/Hr
Net Steam Flow - Gross less Pegging Steam	70,000	52,500	35,000	17,500							Lb/Hr
Pegging Steam	-	-	-	-							Lb/Hr
Steam Pressure - Operating	125	125	125	125							PSIG
Steam Temperature	353	353	353	353							°F
Fuel Input (HHV)	84.2	62.9	41.8	20.9							MMBTU/Hr
Ambient Air Temperature	70	70	70	70							°F
Relative Humidity	60	60	60	60							%
Excess Air	25	25	25	25							%
Flue Gas Recirculation	25	25	25	25							%
Steam Output Duty	69.9	52.4	35.0	17.5							MMBTU/hr
Heat Release Rate - Volumetric	65,504	48,894	32,493	16,284							BTU/FT3-Hr
Heat Release Rate - Area	109,446	81,695	54,290	27,208							BTU/FT2-Hr
Heat Flux	14,580	10,935	7,290	3,645							BTU/FT2-Hr
Feed Water Temperature	227	227	227	227							°F
Water Temperature Leaving Economizer	314	301	288	276							±10°F
Blow Down	1.0	1.0	1.0	1.0							%
Boiler Gas Exit Temperature	532	481	429	382							±10°F
Economizer Gas Exit Temperature	305	285	267	251							±10°F
Air Flow	76,629	57,198	38,011	19,049							Lb/Hr
Flue Gas to Stack	80,489	60,080	39,926	20,009							Lb/Hr
Flue Gas Including FGR	100,611	75,100	49,908	25,011							Lb/Hr
Fuel Flow	3,860	2,881	1,914	959							Lb/Hr
Flue Gas Analysis,Losses,Efficiency - %											
Dry Gas Loss	4.8	4.4	4.0	3.7							%
Air Moisture Loss	0.1	0.1	0.1	0.1							%
Fuel Moisture Loss	10.8	10.7	10.6	10.5							%
Casing Loss	0.3	0.4	0.6	1.2							%
Margin	1.0	1.0	1.0	1.0							%
Efficiency - LHV	92.0	92.4	92.7	92.5							%
Efficiency - HHV	83.0	83.4	83.7	83.5							%
Total Pressure Drop Including Economizer	9.06	5.04	2.23	0.59							IN WC
Products of Combustion - CO2	7.72	7.72	7.72	7.72							% vol.
- H2O	16.39	16.39	16.39	16.39							% vol.
-N2	72.08	72.08	72.08	72.08							% vol.
-O2	3.81	3.81	3.81	3.81							% vol.
-SO2	0.00	0.00	0.00	0.00							% vol.

Fuel Composition - Gas			**BOILER SURFACE AREAS-ft2**		
methane	90	% vol.	Furnace Volume:	1,285	ft3
ethane	5	% vol.	Furnace Projected Area:	769	ft2
nitrogen	5	% vol.	Evaporator:	3,819	ft2
hydrogen sulfide	0.0001	% vol.	Total Area:	4,588	ft2
			Economizer:	9,237	ft2
LHV-Btu/lb	19687		Superheater:	-	ft2
HHV-Btu/lb	21815				

Above data is predicted only, see proposal for guaranteed numbers.