APPENDIX A

EQUIPMENT INFORMATION

- **Gas Turbine Specifications**
- **Emissions Control Systems Specifications**
- **Evaporative Cooling Tower Specifications**

Turbine Performance Specifications
LM6000PC Sprint
Riverside Energy Resource Center

	Spinning 20%	25% Load	50% Load	75% Load	100% Load
Fuel Consumption (MM Btu/hr – LHV) (LHV = 912 Btu/cf)	159.7	243.8	329.8	329.8	425.6
Fuel Consumption (Btu-hr – HHV) (HHV = 1050 Btu/cf)	183.9	280.7	379.7	379.7	490.0
Fuel Consumption (MMcf/hr)	0.175	0.267	0.362	0.362	0.467
Gross Power Output @ 72oF, w/ chiller/cooler (KW/hr)	10000	12450	24709	37350	49800
Net Power Output @ (KW/hr)	9518	11968	24421	35941	48391
Water Injection @ 115oF (lb/hr)	4062	5066	10884	16745	27851
Exhaust Temp (oF) @ 72.2oF	788	806	863	803	830 Normal / 868 Max.
Stack Exhaust Flow (lb/hr) @72.2oF	538561	567996	713782	933301	1064462
Stack Exhaust (ACFM w/quench air)	227366	319264	450294	450294	575520
O2 (Mole % dry) @72.2oF	16.753	16.485	15.445	15.228	14.388
H20 (% vol wet)					10.76

TURBINE GEN SET PERFORMANCE
FOR
RPU - City of Riverside - Capacity Addition

GUARANTEED PARAMETERS		JOBSITE LOCATION: Riverside, CA	Emissions per Unit with GE Supplied SCR
			100% to 50% Load
Btu/kW·hr, LHV	AT	NET PLANT KW	NOx EMISSIONS
8973		96783	2.5 PPMVD AT 15%O2
(kJ/kW·hr, LHV)			CO EMISSIONS
9467		GUARANTEE	6 PPMVD AT 15%O2
		John Mtoy	VOC EMISSIONS
		Date: 1/6/2004	2 PPMVD AT 15%O2
			PM EMISSIONS
			3 lb/hr Per Unit.
			NH3 SLIP
NOT VALID WITHOUT STAMP			5 PPMVD AT 15 % O2

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(2) GE LM6000PC GAS TURBINE w/SPRINT & VIGVs
FUEL:	21153 Btu/lb / (49201 kJ/kg) LHV, GAS FUEL (#900-744)
FUEL TEMP:	50°F(28°C) above dew point,@ GEAEP BASEPLATE Maximum Fuel Temperature 250°F(121.1°C)
Fuel Specification:	MID-TD-0000-1 Latest Revision
GENERATOR OUTPUT:	13.8 kV, 60 Hz
POWER FACTOR:	≥ .9
AMBIENT TEMP:	100.0°F / (37.8°C)
AMBIENT WET BULB:	68.0°F / (20°C)
INLET CONDITIONING:	CHILL TO 46.0°F / (7.8°C), 95% INLET REL HUM
ALTITUDE:	730.0 ft/ (222.5 m)
INLET FILTER LOSS:	≤ 5.00 inH_2O/ (127.0 mmH_2O)
EXHAUST LOSS:	≤ 12.00 inH_2O/ (304.8 mmH_2O)
NOX CONTROL:	WATER
Water Specification:	MID-TD-0000-3 Latest Revision
INJECTION RATE:	22960 PPH/ (10414.5kG/hr) ±20% FLOW
INJECTION TEMP:	100 °F/ (37.8 °C) @ GEAEP BASEPLATE
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
FIELD TEST METHODS	
PERFORMANCE:	GE AERO ENERGY PRODUCTS SGTGPTM
NOx EMISSION:	SCAQMD Method 100.1
CO EMISSION:	SCAQMD Method 100.1
VOC EMISSION:	SCAQMD Method 25.3
*PM	SCAQMD Method 5.1
NH3 SLIP	CTM O27

** SI values are for reference purposes only

THIS GUARANTEE SUPERSEDES ANY PREVIOUS GUARANTEES PRESENTED

* **Conditions for PM Guarantee** requires that each unit have more that 300 fired hours of operation prior to testing. Also, each unit must operate at **Base Load 3 to 4 hours** just prior to commencing PM Compliance Test.

TURBINE GEN SET PERFORMANCE
FOR
RPU - City of Riverside - Capacity Addition

GUARANTEED PARAMETERS

JOBSITE LOCATION: Riverside, CA

Far Field Noise:
70 dBA for 2 main units at a distance of 90 ft from any nearest point of the GTG/SCR Scope of Supply equipment as measured 5 ft above grade over a flat hard ground plane in a free field condition.

This guarantee coincides with the previous guarantee issued on 12/15/2003

TG6000-0000401202-100
14765 14754

GUARANTEE

Date: 12/15/2003

Near Field Noise:
84 dba average around the package (Vertical Distance of 5ft. above grade at a horizontal distance of 3ft. from the exterior plane of equipment or if equipment enclosed, its enclosure)

NOT VALID WITHOUT STAMP

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AMBIENT TEMP:	100.0°F / (37.8°C)
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NOX CONTROL:	WATER
INJECTION RATE:	22960 PPH/ (10414.5kG/hr) ±20% FLOW
INJECTION TEMP:	100 °F/ (37.8 °C) @ GEAEP BASEPLATE
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
FIELD TEST METHODS	
PERFORMANCE:	GE AERO ENERGY PRODUCTS SGTGPTM
NEAR FIELD NOISE:	ANSI / ASME PTC - 36

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THIS GUARANTEE SUPERSEDES ANY PREVIOUS GUARANTEES PRESENTED

TURBINE GEN SET PERFORMANCE
FOR
RPU - City of Riverside - Capacity Addition

GUARANTEED PARAMETERS JOBSITE LOCATION: Riverside, CA
Availability and Starting Reliability and Forced Outage Rate

RPU Formula: SR % = 100 – {100 x (SF+FOE) / (SF+SS)}	RPU Formula: FOR= FOH/(FOH+SH)	RPU Formula: A % = 100 x {(PH-FOH-MOH-POH-AOH)/ (PH- POH-AOH)}
97.49	1.80	98.09

This guarantee coincides with the previous guarantee issued on 12/15/2003

TG6000-0000401202-100

NOT VALID WITHOUT STAMP

GUARANTEE

Date: 12/12/2003

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(2) GE LM6000PC GAS TURBINE w/SPRINT & VIGVs
FUEL:	21153 Btu/lb / (49201 kJ/kg) LHV, GAS FUEL (#900-744)
FUEL TEMP:	50°F(28°C) above dew point,@ GEAEP BASEPLATE Maximum Fuel Temperature 250°F(121.1°C)
GENERATOR OUTPUT:	13.8 kV, 60 Hz
POWER FACTOR:	≥ .9
AMBIENT TEMP:	100.0°F / (37.8°C)
AMBIENT WET BULB:	68.0°F / (20°C)
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EXHAUST LOSS:	≤ 12.00 inH_2O/ (304.8 mmH_2O)
NOX CONTROL:	WATER
INJECTION RATE:	22960 PPH/ (10414.5kG/hr) ±20% FLOW
INJECTION TEMP:	100 °F/ (37.8 °C) @ GEAEP BASEPLATE
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS

NOTES:
- Basis for each is SPS - ORAP.
- ORAP definitions for Availability and Starting Reliability are slightly different than the formulas in the spec, and both have been included attached graphs.

** SI values are for reference purposes only

THIS GUARANTEE SUPERSEDES ANY PREVIOUS GUARANTEES PRESENTED

GE AERO ENERGY PRODUCTS/ GE LM6000PC SPRINT w/ VGVs Standard Estimated Average Engine Performance NOT FOR GUARANTEE
GENERATOR: 290ERT 60Hz 13.80kV 0.90pf
City of Riverside - Capacity Addition

CASE #	100
AMBIENT	
DB, °F	100.0
WB, °F	68.0
RH, %	19.0
ALT, FT	730.0
Ambient Pressure, psia	14.313
ENGINE INLET	
TEMP, °F	46.0
RH, %	95.0
CONDITIONING	CHILL
TONS or kBTU	1293
kW, Gen Terms	49800
Est. Btu/kW-hr, LHV	8545
Guar. Btu/kW-hr, LHV	8719
Aux and BOP Loads, kW	2818
FUEL	
MMBTU/HR, LHV	426
PPH	20118
NOZZLE WATER	
PPH	22960
TEMP °F	59
NOZZLE STEAM	
PPH	0
TEMP °F	0
SPRINT	LPC
PPH	4891
INLET LOSS, INH2O	5
VOLUTE LOSS, INH2O	4
EXHAUST LOSS,INH2O	12
HP COMP, RPM	3600
LP COMP, RPM	10567
COMP DISCH, PSIA	439
COMP DISCH, °F	997
T48, °R	2046
EXHAUST PARAMETERS	
°F	830
PPS	296
PPH	1064462

Net Plant
96783 kW
8794 Est. Btu/kW-hr, LHV
8973 Guar. Btu/kW-hr, LHV

EMISSIONS (NOT FOR USE IN ENVIRONMENTAL PERMITS, NOX & CO PPMVD ARE @ 15% O2)

NOx, PPMVD	25
NOx, PPH	43
CO, PPMVD	42
CO, PPH	44
HC, PPMVD	10
HC, PPH	7
VOC, PPMVD	3
VOC, PPH	2
PM10, PPH	11

EXH WGHT % WET (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	1.2278
N2	72.0007
O2	14.6215
CO2	5.1900
H2O	6.9544
SO2	0.0000
CO	0.0027
HC	0.0002
NO_+_NO2	0.0028

EXH MOLE % DRY (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	0.9677
N2	80.9253
O2	14.3877
CO2	3.7132
SO2	0.0000
CO	
HC	0.0030
NOX	0.0003
	0.0028

EXH MOLE % WET (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	0.8629
N2	72.1550
O2	12.8285
CO2	3.3108
H2O	10.8375
SO2	0.0000
CO	0.0027
HC	0.0003
NOX	0.0025

Aero Energy Fuel Number	**900-744**	
	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	98.5565	96.8910
Ethane	0.6290	1.1590
Ethylene	0.0000	0.0000
Propane	0.0655	0.1770
Propylene	0.0000	0.0000
Butane	0.0177	0.0630
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0043	0.0190
Cyclopentane	0.0000	0.0000
Hexane	0.0034	0.0180
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	0.4394	1.1851
Nitrogen	0.2842	0.4879
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000

Btu/lb, LHV	21153
Btu/scf, LHV	912
Btu/scf, HHV	1012
Btu/lb, HHV	23465
Fuel Temp, °F	77.0
NOx Scalar	0.991
Specific Gravity	0.56

TOTAL SPRINT FLOW, PPH	4891.382429
HPC SPRINT FLOW, GPM	0
LPC SPRINT FLOW, GPM	9.77
GT OUTPUT, SHP	67949
GT AVG HR, BTU/HP-HR	6263
GENERATOR EFFICIENCY	0.982852944
EXHAUST TEMPERATURE, °R	1290.1
MEDIA INJ TEMP, °R	518.67
MEDIA INJ FLOW, PPH	22960
FUEL FLOW, PPH	20118
FUEL LHV, BTU/LB	21153
T48, °F	1586.0
INLET FLOW, PPS	286.12
EXHAUST AVG MW	28.2

Estimated Average Engine Performance NOT FOR GUARANTEE

GE Aero Energy
A GE Power Systems Business

Performance By: **Johnny Metcalf**
Project Info:

Engine: **LM6000 PC-SPRINT w/ VIGVs**
Deck Info: **GE125M - Multiple Cardpacks being used, See Cardpack Row Below** Date: **01/29/2004**
Generator: **290ERT 60Hz, 13.8kV, 0.9PF (14839)** Time: **11:32:25 AM**
Fuel: **Sita Gas Fuel#900-744, 21153 Btu/lb,LHV** Version: **3.0.16**

			NOx, lbs	CO, lbs
Startup Ramp Rate:	11173 kW/min	Total Emissions at Startup	**2.5**	**3.9**

Case #	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**	**109**	**110**	**111**	**112**	**113**	**114**	**115**	**116**	**117**
Ambient Conditions																		
Dry Bulb, °F	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8
Wet Bulb, °F	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2
RH, %	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	60.0
Altitude, ft	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0	730.0
Ambient Pressure, psia	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313	14.313
Engine Inlet																		
Temperature, °F	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8
RH, %	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	60.0
Conditioning	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
Tons or kBtu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pressure Losses																		
Inlet Loss, inH20	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Volute Loss, inH20	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Exhaust Loss, inH20	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Time, min	10.0000	9.25	9.08	8.92	8.76	8.60	8.44	8.27	8.11	7.95	7.79	7.62	7.46	7.30	7.14	6.95	6.89	6.82
kW, Gen Terms	**44693**	**36274**	**34468**	**32655**	**30842**	**29029**	**27215**	**25402**	**23589**	**21777**	**19964**	**18152**	**16340**	**14527**	**12716**	**10657**	**9916**	**9174**
Est. Btu/kW-hr, LHV	**8659**	**8878**	**8970**	**9081**	**9212**	**9365**	**9534**	**9718**	**9929**	**10196**	**10501**	**10863**	**11317**	**11873**	**12612**	**13458**	**13975**	**14584**
Guar. Btu/kW-hr, LHV	**8836**	**9060**	**9153**	**9266**	**9400**	**9556**	**9728**	**9916**	**10131**	**10404**	**10715**	**11085**	**11548**	**12115**	**12869**	**13733**	**14260**	**14881**
Fuel Flow																		
MMBtu/hr, LHV	387.0	322.1	309.2	296.5	284.1	271.9	259.5	246.9	234.2	222.0	209.6	197.2	184.9	172.5	160.4	143.4	138.6	133.8
lb/hr	18295	15225	14616	14019	13431	12852	12266	11670	11073	10497	9911	9322	8742	8154	7582	6781	6551	6325
lb/min	305	254	244	234	224	214	204	195	185	175	165	155	146	136	126	113	109	105
scfm	7073	5887	5651	5419	5193	4970	4743	4513	4280	4058	3831	3604	3379	3153	2932	2621	2533	2445
lbs	1096.6	866.8	825.8	786.3	748.4	712.1	677.3	644.1	612.6	582.6	554.2	527.5	502.3	478.6	456.6	433.3	425.8	418.6
scf	25433.1	20103.5	19151.9	18234.9	17355.6	16513.0	15706.2	14936.6	14204.4	13510.2	12851.8	12230.6	11646.1	11097.7	10586.7	10046.5	9872.6	9704.4
NOx Control	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**Water**	**NONE**	**NONE**	**NONE**
Water Injection																		
lb/hr	19755	15764	14711	13653	12581	11619	10686	9744	8828	8019	7188	6385	5655	4902	4210	0	0	0
Temperature, °F	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
SPRINT	**LPC**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**	**OFF**
lb/hr	7093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Control Parameters																		
HP Speed, RPM	10565	10340	10256	10187	10122	10057	9994	9929	9863	9777	9691	9620	9555	9479	9400	9307	9267	9227
LP Speed, RPM	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600	3600
CDP, psia	425.599	380.575	369.976	358.511	346.106	333.349	320.201	306.364	291.416	281.222	271.016	260.793	250.344	240.110	229.283	216.355	211.689	206.943
CDT, °F	998.0	1001.0	989.5	976.7	962.0	946.5	931.8	916.8	901.3	887.1	872.6	857.5	842.2	826.6	810.6	789.9	782.9	775.9
T48, °R	2023	1963	1945	1929	1915	1902	1889	1877	1869	1845	1819	1791	1761	1728	1697	1672	1656	1640
Exhaust Parameters																		
Temperature, °F	832.3	816.0	810.7	807.6	806.9	807.5	809.3	812.6	819.5	811.3	801.4	790.3	779.6	766.5	755.8	751.6	745.4	739.7
lb/sec	277.3	253.3	247.5	240.9	233.4	225.6	217.4	208.7	198.9	193.3	187.7	182.2	176.4	170.9	164.8	157.2	154.6	151.8
lb/hr	998176	911750	890957	867189	840246	812237	782805	751283	716063	695839	675835	655872	635061	615218	593262	565787	556385	546634
Energy, Btu/s- ref 0 °R	93135	83037	80688	78247	75702	73156	70554	67849	64998	62647	60252	57836	55410	52991	50551	47684	46619	45558
Cp, Btu/lb-R	0.2778	0.2739	0.2733	0.2729	0.2726	0.2723	0.2721	0.2720	0.2721	0.2714	0.2705	0.2696	0.2688	0.2678	0.2670	0.2647	0.2643	0.2640
Emissions (NOT FOR USE IN ENVIRONMENTAL PERMITS)																		
REF @ 15% O2	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
NOx ppmvd Ref 15% O2	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	66	63	60
NOx as NO2, lb/hr	39	32	31	30	28	27	26	25	23	22	21	20	19	17	16	38	35	32
NOx, min	0.65	0.54	0.52	0.50	0.47	0.45	0.43	0.41	0.39	0.37	0.35	0.33	0.31	0.29	0.27	0.63	0.58	0.54
CO ppmvd Ref 15% O2	19	13	13	13	13	13	13	13	13	13	12	12	12	11	11	13	14	16
CO, lb/hr	17.85	10.46	10.06	9.56	8.97	8.75	8.39	7.87	7.36	6.95	6.37	5.81	5.37	4.79	4.29	4.39	4.74	5.18
CO, min	0.30	0.17	0.17	0.16	0.15	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.09	0.08	0.07	0.07	0.08	0.09
HC ppmvd Ref 15% O2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
HC, lb/hr	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Total Emissions From Startup To Full Load																		
NOx, lbs	**2.5**	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.3	1.3	1.2	1.1	1.1	1.1	1.0	1.0
CO, lbs	**3.9**	3.6	3.6	3.6	3.6	3.5	3.5	3.5	3.5	3.5	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.3
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)																		
AR	1.2256	1.2312	1.2326	1.2339	1.2351	1.2361	1.2372	1.2382	1.2391	1.2406	1.2423	1.2440	1.2456	1.2475	1.2492	1.2593	1.2595	1.2598
N2	71.8713	72.1998	72.2798	72.3549	72.4259	72.4879	72.5481	72.6092	72.6624	72.7505	72.8482	72.9491	73.0444	73.1523	73.2528	73.8409	73.8566	73.8719
O2	14.7876	15.5782	15.7180	15.8348	15.9275	16.0100	16.0885	16.1606	16.2044	16.3796	16.5744	16.7821	16.9870	17.2205	17.4371	17.9278	18.0152	18.0999
CO2	5.0486	4.5723	4.4927	4.4278	4.3788	4.3350	4.2934	4.2566	4.2376	4.1352	4.0212	3.8991	3.7777	3.6392	3.5108	3.2955	3.2384	3.1830
H20	7.0622	6.4148	6.2734	6.1451	6.0291	5.9275	5.8293	5.7321	5.6531	5.4908	5.3106	5.1227	4.9423	4.7377	4.5475	3.6711	3.6251	3.5804
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0018	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0010	0.0010	0.0010	0.0009	0.0009	0.0008	0.0008	0.0007	0.0008	0.0009	0.0009
HC	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
NOX	0.0027	0.0024	0.0024	0.0024	0.0023	0.0023	0.0023	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019	0.0019	0.0046	0.0043	0.0041
Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS)																		
AR	0.9668	0.9635	0.9629	0.9624	0.9621	0.9617	0.9614	0.9612	0.9610	0.9603	0.9595	0.9587	0.9578	0.9569	0.9560	0.9544	0.9541	0.9537
N2	80.8494	80.5659	80.5181	80.4790	80.4490	80.4223	80.3970	80.3744	80.3620	80.3020	80.2356	80.1648	80.0949	80.0155	79.9422	79.8087	79.7775	79.7473
O2	14.5637	15.2190	15.3294	15.4198	15.4891	15.5508	15.6093	15.6616	15.6902	15.8287	15.9823	16.1459	16.3074	16.4909	16.6601	16.9642	17.0366	17.1067
CO2	3.6151	3.2478	3.1858	3.1350	3.0961	3.0615	3.0287	2.9993	2.9833	2.9055	2.8193	2.7275	2.6368	2.5339	2.4389	2.2673	2.2266	2.1873
H20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0020	0.0013	0.0013	0.0012	0.0012	0.0012	0.0012	0.0012	0.0011	0.0011	0.0010	0.0010	0.0009	0.0009	0.0008	0.0008	0.0009	0.0010
HC	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001
NOX	0.0027	0.0024	0.0024	0.0023	0.0023	0.0023	0.0022	0.0022	0.0022	0.0021	0.0021	0.0020	0.0019	0.0019	0.0018	0.0044	0.0041	0.0039
Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)																		
AR	0.8605	0.8670	0.8685	0.8700	0.8713	0.8725	0.8737	0.8749	0.8759	0.8776	0.8795	0.8815	0.8834	0.8855	0.8875	0.8990	0.8993	0.8996
N2	71.9596	72.4962	72.6257	72.7469	72.8612	72.9610	73.0580	73.1562	73.2413	73.3857	73.5461	73.7121	73.8696	74.0483	74.2149	75.1706	75.1987	75.2259
O2	12.9624	13.6946	13.8268	13.9384	14.0282	14.1081	14.1844	14.2550	14.2999	14.4654	14.6498	14.8463	15.0400	15.2611	15.4665	15.9783	16.0588	16.1368

Estimated Average Engine Performance NOT FOR GUARANTEE

GE Aero Energy
A GE Power Systems Business

Performance By: **Johnny Metcalf**
Project Info:

Engine: **LM6000 PC-SPRINT w/ VIGVs**
Deck Info: **GE125M - Multiple Cardpacks being used, See Cardpack Row Below**
Generator: **290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Site Gas Fuel#900-744, 21153 Btu/lb,LHV**

Date: **01/29/2004**
Time: **11:32:25 AM**
Version: **3.0.16**

						NOx, lbs	CO, lbs										
CO2	3.2176	2.9224	2.8735	2.8338	2.8041	2.7774	2.7522	2.7300	2.7189	2.6552	2.5842	2.5079	2.4319	2.3449	2.2642	2.1355	2.0988	2.0632
H20	10.9955	10.0163	9.8021	9.6077	9.4319	9.2777	9.1285	8.9807	8.8609	8.6130	8.3374	8.0493	7.7723	7.4576	7.1644	5.8115	5.7395	5.6697
SO2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO	0.0018	0.0012	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0010	0.0010	0.0010	0.0009	0.0009	0.0008	0.0007	0.0008	0.0009	0.0010
HC	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
NOX	0.0024	0.0022	0.0021	0.0021	0.0021	0.0021	0.0020	0.0020	0.0020	0.0020	0.0019	0.0019	0.0018	0.0017	0.0017	0.0041	0.0039	0.0037

Aero Energy Fuel Number	**900-744**	
	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	98.5565	96.8910
Ethane	0.6290	1.1590
Ethylene	0.0000	0.0000
Propane	0.0655	0.1770
Propylene	0.0000	0.0000
Butane	0.0177	0.0630
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0043	0.0190
Cyclopentane	0.0000	0.0000
Hexane	0.0034	0.0180
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	0.4394	1.1851
Nitrogen	0.2842	0.4879
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000

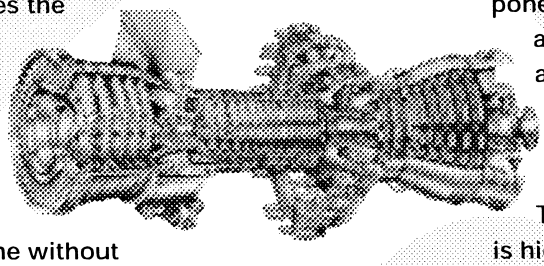
Btu/lb, LHV	21153
Btu/scf, LHV	912
Btu/scf, HHV	1012
Btu/lb, HHV	23465
Fuel Temp, °F	77.0
NOx Scalar	0.991
Specific Gravity	0.56

Engine Exhaust																		
Exhaust MW	28.0	28.1	28.1	28.2	28.2	28.2	28.2	28.2	28.2	28.3	28.3	28.3	28.3	28.4	28.4	28.5	28.5	28.5
Exhaust Flow, ACFM	557320	501214	487398	472930	457727	442464	426817	410503	393204	379357	365264	351045	336715	322451	307974	291293	284928	278571
Exhaust Flow, SCFM	212268	193652	189020	183693	177644	171372	164834	157895	150198	145844	141531	137231	132762	128497	123798	117497	115527	113485
Exhaust Flow, Btu/lb	336	328	326	325	324	324	324	325	327	324	321	317	314	310	307	303	302	300
Exhaust Flow, Calories/s	23469963	20925279	20333299	19718293	19076843	18435414	17779645	17097855	16379433	15787056	15183426	14574627	13963368	13353613	12738952	12016385	11747907	11480529
Inlet Flow Wet, pps	268.2	247.9	242.9	238.7	235.2	231.2	225.9	219.3	212.0	212.1	212.1	212.1	212.2	212.1	212.3	212.4	212.4	212.3
Inlet Flow Dry, pps	265.4	245.3	240.4	236.2	232.7	228.7	223.5	217.0	209.8	209.8	209.9	209.9	210.0	209.9	210.0	210.1	210.1	210.1
Shaft HP	61014	49603	47158	44704	42252	39800	37349	34899	32450	30002	27555	25109	22664	20219	17776	15000	14000	13000
Generator Information																		
Capacity kW	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333	60333
Efficiency	0.982	0.981	0.980	0.980	0.979	0.978	0.977	0.976	0.975	0.973	0.972	0.969	0.967	0.964	0.959	0.953	0.950	0.946
Inlet Temp, °F	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8
Gear Box Loss	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
8th Stage Bleed																		
Flow, pps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pressure, psia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Temperature, °R	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CDP Bleed																		
Flow, pps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pressure, psia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Est. Gas Pressure at Baseplate, psi	**549.8**	**481.3**	**466.4**	**451.0**	**434.9**	**418.6**	**401.9**	**384.5**	**366.2**	**351.9**	**337.5**	**323.0**	**308.5**	**294.1**	**279.4**	**260.7**	**254.5**	**248.4**
CardPack	**81e**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**	**7tx**
NSI	**327**	**305**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
NSI	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
NSI	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

LM6000 SPRINT™ Gas Turbine Generator Set

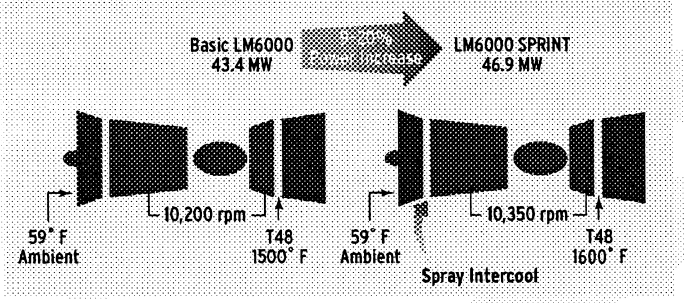
The Inter-cooled Engine that Increases Power Output

The LM6000 SPRINT™ combines the best simple-cycle heat rate of any industrial gas turbine in its class today with a spray inter-cooling design that significantly increases the mass airflow by cooling the air during the compression process. The result is more power, a better heat rate and a gas turbine without any increase in maintenance costs.



The Hotter It Gets, The More Effectively It Runs

SPRINT's™ effectiveness is even more pronounced in hot weather—power output is increased by 9% at ISO and is increased by more than 20% on 90° days. It is like having an evaporative cooler built within the gas turbine. As ambient temperature rises, the benefits of a SPRINT™ engine become more significant.

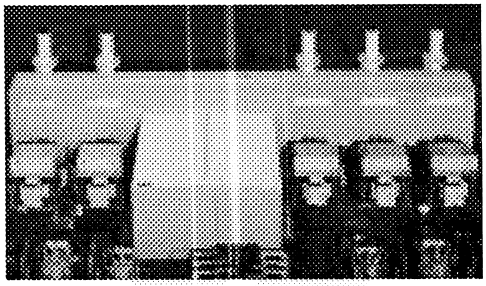


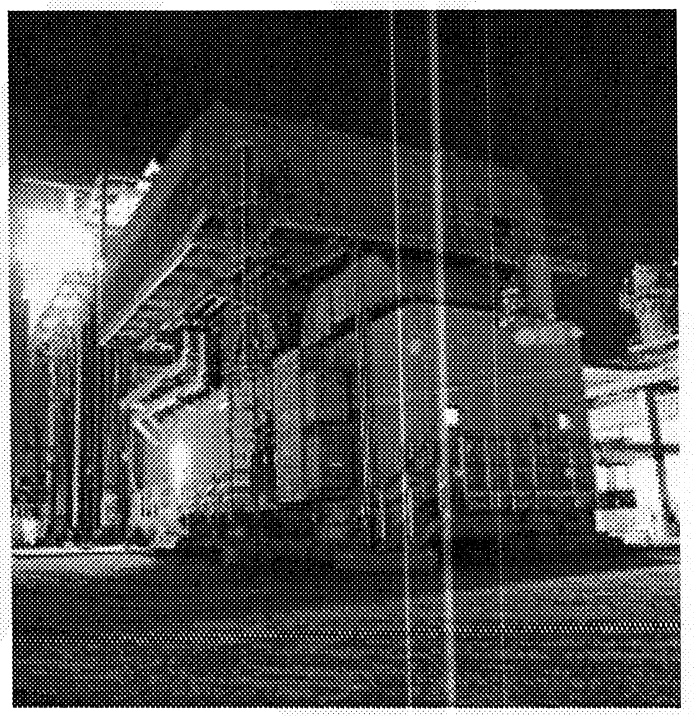
The SPRINT™ Solution

The SPRINT™ system is based on an atomized water spray injected through spray nozzles into the compressor. Water is atomized using high-pressure air taken off of eighth stage air bleed. The water-flow rate is metered, using the appropriate engine control schedules.

The SPRINT™ Solution at Work

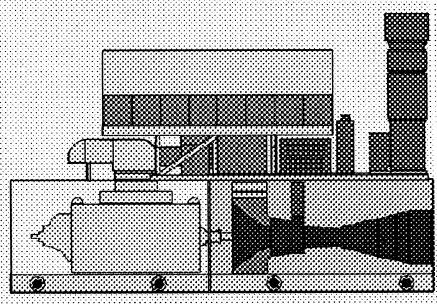
On high-pressure ratio gas turbines such as the LM6000, the compressor discharge temperature is often the criteria that limits power output because compressed air is used to cool the hot section components. By pre-cooling the LM6000 compressor with a mico-mist of water, the compressor inlet temperature and outlet temperature are significantly reduced. Thus, the compressor outlet temperature limitation is reduced allowing the LM6000 to operate on its natural firing temperature control. The result is higher output and better efficiency.





SPRINT 60-Hz Generator Sets

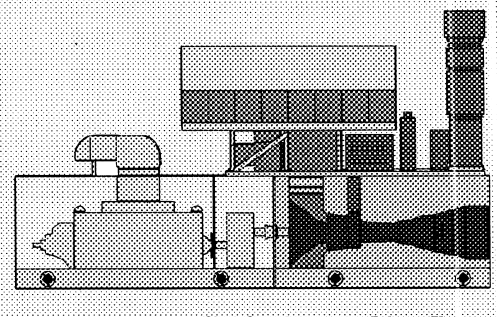
Base Plate Length	56' 6"	(17.22 m)
Base Plate Width	13' 6"	(4.11 m)
Enclosure Height	14' 6"	(4.42 m)
Overall Length	56' 9"	(17.30 m)
Overall Width*	49' 9"	(15.16 m)
Overall Height*	36' 2"	(11.02 m)
Base Plate Foundation Load*	476,000 lb	(214,200 kg)



	Power kW	Heat Rate Btu/kWh LHV	Heat Rate kJ/kWh LHV	No. Shafts	Pressure Ratio	Shaft Speed rpm	Exhaust Flow lb/s	Exhaust Flow kg/s	Exhaust Temp. °F	Exhaust Temp. °C
LM6000PC SPRINT*	50080	8434	8916	2	30.9	3600	295	134	826	441
LM6000PC	43417	8112	8549	2	29.1	3600	281	127	831	444
LM6000PD SPRINT	46824	8235	8688	2	30.7	3600	290	131	837	447
LM6000PD	42336	8308	8765	2	29.3	3600	278	126	846	452
LM6000PD (liquid fuel)	40212	8415	8878	2	28.1	3600	268	122	857	458
LM2500PK	30676	8834	9300	2	23.6	3600	192	87.1	958	514
LM2500PV	30463	8854	9069	2	22.6	6100	186	84.3	931	499
LM2500PH**	27763	8391	8775	2	20.2	3600	167	75.9	926	497
LM2500PE	22719	9311	9789	2	19.1	3600	153	69.4	992	533

SPRINT 50-Hz Generator Sets

Base Plate Length	64' 7"	(19.69 m)
Base Plate Width	13' 6"	(4.11 m)
Enclosure Height	14' 6"	(4.42 m)
Overall Length	64' 10"	(19.76 m)
Overall Width*	49' 3"	(15.01 m)
Overall Height*	37' 11"	(11.56 m)
Base Plate Foundation Load*	522,000 lb	(234,900 kg)



	Power kW	Heat Rate Btu/kWh LHV	Heat Rate kJ/kWh LHV	No. Shafts	Pressure Ratio	Shaft Speed rpm	Exhaust Flow lb/s	Exhaust Flow kg/s	Exhaust Temp. °F	Exhaust Temp. °C
LM6000PC SPRINT*	50041	8461	8961	2	31.0	3627	297	135	821	438
LM6000PC	42890	8173	8617	2	29.1	3627	282	128	825	441
LM6000PD SPRINT	46902	8272	8739	2	30.9	3627	292	133	834	446
LM6000PD	41711	8374	8846	2	29.3	3627	279	127	838	448
LM6000PD (liquid fuel)	40376	8452	8917	2	28.5	3627	272	123	853	456
LM2500PK	29244	9177	9675	2	22.8	3000	193	87.7	967	519
LM2500PV	30349	8577	9069	2	21.5	6100	186	84.3	931	499
LM2500PH**	26463	8673	9080	2	19.4	3000	168	76.2	932	500
LM2500PE	21719	9653	10141	2	18	3000	154	69.8	1000	538

Mechanical-Drive Sets

	Heat Rate Btu/kWh LHV	No. Shafts	Pressure Ratio	Shaft Speed rpm	Exhaust Flow lb/s	Exhaust Flow kg/s	Exhaust Temp. °F	Exhaust Temp. °C
LM6000PC	5941	2	29.1	3600	281.9	127.8	825	440
LM2500PK	6442	2	22.5	3600	192.0	87.1	958	514
LM2500PV	6187	2	21.5	6100	186.0	84.3	931	499
LM2500PE	6773	2	22.8	3600	153.0	69.4	992	533

Note: Performance based on 59° F amb. Temp. 60% RH, sea level, no inlet/exhause losses on gas fuel without NOx media, unless otherwise specified.

*SPRINT 2002 deck is used with water injection to 25ppmvd for power enhancement

**Rating includes use of 50,000 lb/hr steam injection.

GE Aero Energy Products

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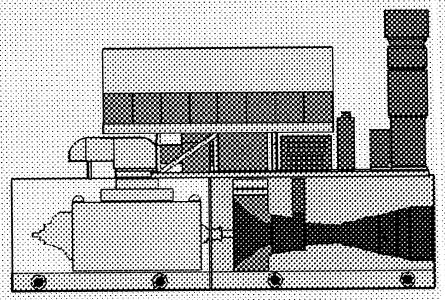
3/03

SPRINT™ 60-Hz Generator Sets

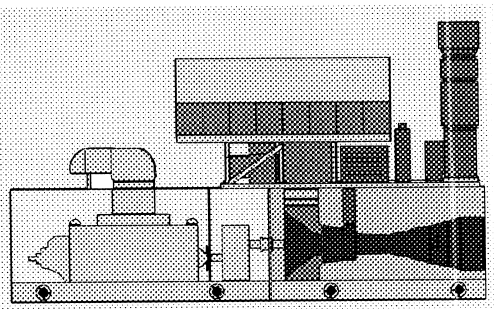
Base Plate Length	56'	6"	(17.22 m)
Base Plate Width	13'	6"	(4.11 m)
Enclosure Height	14'	6"	(4.42 m)
Overall Length	56'	9"	(17.30 m)
Overall Width*	49'	9"	(15.16 m)
Overall Height*	36'	2"	(11.02 m)
Base Plate Foundation Load*	476,000 lb		(214,200 kg)



	Power kW	Heat Rate Btu/kWh LHV	Heat Rate kJ/kWh LHV	No. Shafts	Pressure Ratio	Shaft Speed rpm	Exhaust Flow lb/s	Exhaust Flow kg/s	Exhaust Temp. °F	Exhaust Temp. °C
LM6000PC SPRINT™ *	50080	8434	8916	2	30.9	3600	295	134	826	441
LM6000PC	43417	8112	8549	2	29.1	3600	281	127	831	444
LM6000PD SPRINT™	46824	8235	8688	2	30.7	3600	290	131	837	447
LM6000PD	42336	8308	8765	2	29.3	3600	278	126	846	452
LM6000PD (liquid fuel)	40212	8415	8878	2	28.1	3600	268	122	857	458
LM2500PK	30676	8834	9300	2	23.6	3600	192	87.1	958	514
LM2500PV	30463	8854	9069	2	22.6	6100	186	84.3	931	499
LM2500PH**	27763	8391	8775	2	20.2	3600	167	75.9	926	497
LM2500PE	22719	9311	9789	2	19.1	3600	153	69.4	992	533

SPRINT™ 50-Hz Generator Sets

Base Plate Length	64'	7"	(19.69 m)
Base Plate Width	13'	6"	(4.11 m)
Enclosure Height	14'	6"	(4.42 m)
Overall Length	64'	10"	(19.76 m)
Overall Width*	49'	3"	(15.01 m)
Overall Height*	37'	11"	(11.56 m)
Base Plate Foundation Load*	522,000 lb		(234,900 kg)



	Power kW	Heat Rate Btu/kWh LHV	Heat Rate kJ/kWh LHV	No. Shafts	Pressure Ratio	Shaft Speed rpm	Exhaust Flow lb/s	Exhaust Flow kg/s	Exhaust Temp. °F	Exhaust Temp. °C
LM6000PC SPRINT™ *	50041	8461	8961	2	31.0	3627	297	135	821	438
LM6000PC	42890	8173	8617	2	29.1	3627	282	128	825	441
LM6000PD SPRINT™	46902	8272	8739	2	30.9	3627	292	133	834	446
LM6000PD	41711	8374	8846	2	29.3	3627	279	127	838	448
LM6000PD (liquid fuel)	40376	8452	8917	2	28.5	3627	272	123	853	456
LM2500PK	29244	9177	9675	2	22.8	3000	193	87.7	967	519
LM2500PV	30349	8577	9069	2	21.5	6100	186	84.3	931	499
LM2500PH**	26463	8673	9080	2	19.4	3000	168	76.2	932	500
LM2500PE	21719	9653	10141	2	18	3000	154	69.8	1000	538

Mechanical-Drive Sets

	Heat Rate Btu/kWh LHV	No. Shafts	Pressure Ratio	Shaft Speed rpm	Exhaust Flow lb/s	Exhaust Flow kg/s	Exhaust Temp. °F	Exhaust Temp. °C
LM6000PC	5941	2	29.1	3600	281.9	127.8	825	440
LM2500PK	6442	2	22.5	3600	192.0	87.1	958	514
LM2500PV	6187	2	21.5	6100	186.0	84.3	931	499
LM2500PE	6773	2	22.8	3600	153.0	69.4	992	533

Note: Performance based on 59° F amb. Temp. 60% RH, sea level, no inlet/exhause losses on gas fuel without NOx media, unless otherwise specified.

*SPRINT™ 2002 deck is used with water injection to 25ppmvd for power enhancement

**Rating includes use of 50,000 lb/hr steam injection.

GE Aero Energy Products

A GE Power Systems Business

2707 North Loop West • Houston, TX 77008 • Phone: 713.803.0900 • Fax: 713.803.0362 • www.gepower.com

3/03

Environmental

A leader in clean air technology for more than 60 years, Engelhard has unsurpassed expertise in the development of environmental catalysts for a wide range of applications that protect the air we breathe.

Catalyst expertise enabled Engelhard to pioneer the development of the first catalytic converters for automobiles. One of the most important pollution abatement devices ever invented, the catalytic converter reduces tailpipe emissions by up to 97 percent. The catalytic converter is now a key component of every car driven in America.

Engelhard environmental catalysts are also used today to minimize emissions from buses, trucks,motorcycles, and mopeds. Environmental catalysts are also effective in the reducing stack emissions from power plants and factories.

Though not as visible as cars, buses, trucks or giant smokestacks, small engines are a major source of pollution. Weed wackers, leaf blowers, and lawn mowers are meaningful sources of pollution right in our own backyards. Engelhard environmental catalysts makes these tools and equipment run cleaner.

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Volvo introduces smog eating cars featuring Engelhard technology

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CORMETECH

Technical Data

Download PDFs of technical papers by clicking on the links at right.

Cormetech has shared its knowledge and experience with the industry through technical papers presented at conferences and symposiums. You can access papers presented by Cormetech's experts here.

- Zero Ammonia Slip Technology for Combined Cycle Gas Turbine Exhaust
- B&W's NOx Reduction Systems and Equipment at Moss Landing Power Plant
- SCR Catalyst Performance Under Severe Operating Conditions
- ICAC Forum '94
  Living With Air Toxics and NOx Emissions Controls
- Implementation of SCR System at TVA Paradise 2
- Optimizing SCR Catalyst Design and Performance for Coal-Fired Boilers
- Catalyst Design Experience for 640 MW Cyclone Boiler Fired with 100% PRB Fuel
- Successful Implementation of Cormetech Catalyst in High Sulfur Coal-Fired SCR Demonstration Project
- Quality Assurance of Catalysts During the Life of SCR Systems Through Periodic Laboratory Performance Testing

Karl Lany

From: andrew.morton@ps.ge.com
Sent: Wednesday, February 18, 2004 5:38 PM
To: rbg@ci.riverside.ca.us; dtateosian@powereng.com
Cc: harry.cotham@ss.ps.ge.com; jimmy.holub@ps.ge.com
Subject: FW: Riverside Air Permit Issue

RIVERSIDE RTUP EMISSION 72

RIVERSIDE RTUP EMISSION 10

Bob, attached are the NOx and CO emissions during the 10-minute start-up for
the 73F and 100F degree days and comments from our SCR supplier. Note that the ATS Express SCR is fitted with an ammonia pre-heater that heats the injection chamber, allowing for injection of NH3 once the unit has reached base load after 10 minutes. Emission levels will be within specified requirements soon after the injection begins.

Begin comments:
"During a cold start, it will take some time before the SCR ammonia injection chamber is hot enough to heat the ammonia for injection and the catalysts are hot enough to react effectively. That being said, it has been our experience that air permits will allow for this during the 10 minute start-up of the CTG, so expected emissions out of the SCR stack during the 10 minute start will be the same as what is coming from the turbine. The SCR includes an electric pre-heater for the ammonia injection chamber, eliminating the need to wait for the ammonia injection chamber to come to temperature. Upon completion of the 10 minute CTG start cycle, the SCR will be ready to inject ammonia and the catalysts will be at an adequate temperature to react with the exhaust. After 10 minutes, the SCR will be fully capable of making the guaranteed emissions levels.

Short answer is during the 10 minute start, the emissions levels are per the attached performance. After 10 minutes, the SCR can meet the guaranteed emissions levels per our guarantee PROVIDED that RPU does not disable/deactivate the ammonia injection grid pre-heater prior to the 10 minute start.

The volumetric air flow of the SCR's tempering air fans is 18,200 CFM. I've attached Excel versions of the expected start-up emissions that included the volumetric air flow from the turbine. Add these together for each case and you have the total volumetric air flow of the system."
End comment.

Notes:
- 10 minute startups assume SCR purge requirements have been satisfied prior to startup
- gas turbine volumetric flow rates are shown in the attached spreadsheet for the stated load conditions.
- Cases shown have no inlet air conditioning during startup

Let me know if you need additional info on this subject or others.

Regards,
Andrew

8. Equipment Data Sheets:

DATA SHEET FOR CO AND SCR - BASE			
1.0	**Design and Construction Details**	**CO**	**SCR**
1.1	Catalyst material	Pt. on Alumina	Ti-V-W
1.2	Catalyst manufactured by	Engelhard	Cormetech, Inc.
1.3	Number of catalyst layers	1	1
1.4	Total number of modules	Later	8
1.5	Catalyst Module length x width x height (ft)	Later	31.75"d x 106.125"w x 78.5"h
1.6	Include room for a spare layer	Yes	Yes / No
1.7	Catalyst module cells per sq in.	155	84
1.8	Catalyst space volume {ratio of gas volume (ft^3/hr) and catalyst volume in service (ft^3)}	Nom. 205,000 Max.	15350
1.9	a) Catalyst conversion efficiency %	See Proposal – 95% Min.	90
	b) Catalyst efficiency after 10000 hours of operation	See Proposal – 95% Min.	90
1.10	Catalyst washing requirements	DE-ION Water	N/A
1.11	The maximum temp. catalyst can withstand ^0F	1250	600 °C (cumulative 4 hours)
1.12	Minimum operating catalyst temperature ^0F	500	485
1.13	Over temperature protection for catalyst	Alarm	Alarm
1.14	Differential pressure protection	Alarm	Alarm
1.15	Exhaust gas face velocity through catalyst housing, fps	20 Max.	9.0
1.16	Ammonia Injection Grid (AIG)	N/A	
	Number of headers	N/A	8
	Branches per header	N/A	7
	AIG pipes total	N/A	64
1.17	Ammonia Flow Control Skid	N/A	
	Number of blowers / fans provided	N/A	2 x 100%
	Atomizing air requirements (CFM)	N/A	660
	How is the ammonia injection skid controls interfaced with plant controls?	N/A	Via GE Fanuc PLC
1.18	Catalyst support frame / structure	A387-11 or SS	A387 Grade 11 Chrome Moly
1.19	Number of test elements provided for each layer of catalyst	8	8 test elements plus 3 spare
1.20	List of catalyst poisons and operating conditions that may reduce the life of catalyst.	See Warranty	See catalyst poisons document
1.21	Catalyst life, (operating hours)	25,000	25,000
1.22	Pressure drop, (In of WC)	1.7" wg Max.	4.6
1.23	Lifting equipment and tools	N/R	TBD
1.24	At design operating conditions, estimated ammonia consumption, lb/hr	N/A	76 (19% aqueous)
1.25	Will the catalyst supplier accept spent catalyst for disposal?	Yes	No

1.26	Type of gaskets used	Zetex Rope	Pillow gasket (fiberglass tape around fiberglass blanket)
2.0	**Ducting, Insulation and Lagging**		
2.1	Duct external material and thickness	¼" A36	¼" A36
2.2	Duct internal material and thickness	12 GA 409SS	12 GA 409SS
2.3	Internally Insulated / External insulation	4" Internal	4" Internal
2.4	Insulation Material and Density	8# Ceramic Fiber	8# Ceramic Fiber
2.5	Lagging material and thickness	N/A	N/A
2.6	Stack height and diameter	80 Ft. 13' – 0" I.D.	
3.0	List out the flow model studies included in the proposal.	Nels Physical Model	
4.0	Total auxiliary power consumption for the SCR and CO system	176.4 KW @ Operating Guarantee Pt. (per system)	
5.0	Ammonia consumption rates. (gpm)	See Gas Turbine Data Sheets	

DATA SHEET FOR AMMONIA SYSTEM

1.0	**General Information**	
1.1	Equipment Name	Aqua Ammonia Storage Tank
1.2	Purpose of the equipment	To store reactant used in SCR
1.3	Size	1x 12,000 Gal (net capacity)
1.4	Type	Horizontal, ASME Section-VIII construction.
1.5	Fluid	19% aqua ammonia
1.6	Other details	Vessel shall be provided with safety relief and vacuum breaker.
2.0	**Specific Information**	
2.1	Process Connections	Proposer to Provide a P&ID and show connections
2.3	Average operating temperature	70° F
2.4	Maximum operating temperature	100° F
2.6	Normal operating pressure	150 psig
2.7	Maximum operating pressure	225 psig
3.0	**Construction Details**	**Proposer to fill in all the data**
3.1	Design Pressure	250 psig
3.2	Design Temperature	150° F
3.3	Test Pressure	325 psig
3.4	Maximum permissible temperature for the vessel	-20 / 150° F
3.5	Shell / Vessel Internal diameter	96"
3.6	Shell thickness	0.875"
3.7	Corrosion allowance	0.625"
3.8	Saddle Support thickness	0.5"
3.9	Connections (Size/Pressure Class/End Preparation):	
	▪ Truck unloading fill connection	2" / 150# / RF
	▪ Drains outlet	2" / 150# / RF
	▪ Vessel relief valve	2" / 150# / RF
	▪ Vessel vent connection	2" / 150# / RF
	▪ Inspection connection	18" / 150# / RF
	▪ Connection for level gage	4" / 150# / RF
	▪ Connection for pressure gage	½" NPT / 3000 /cplg
	▪ Temperature thermowell	¾" NPT / 3000# / cplg
	▪ Transfer pump suction connection	2" / 150# / RF
	▪ Vapor return connection	2" / 150# / RF
3.10	Code requirements	ASME Section VIII, Div-I
3.11	Type of joints, vessel side	Welded
3.12	Radiography Shell and dish ends	100% FXR
3.13	Magnetic particle inspection	Yes
3.14	Stress relief	Yes
3.15	Surface preparation inside and external	INT–Blast & Corr. Inh./EXT-Blast & Paint
3.16	Insulation clips (for applying 1" thick insulation)	N/A
4.0	**Materials of Construction**	
4.1	Shell	SA 516-70
4.2	Saddle support	A 36
4.3	Connection isolation valves	SS Trim - Ball Valve

DATA SHEETS FOR PUMPS

1.0	Design Parameters	Proposer to fill in the data		
1.1	Name of the pump	Milton Ray		
1.2	Number of Pumps (operating + standby)	(1+1)		
1.3	Fluid Pumped:	19% Aqueous Ammonia		
1.4	Design Flow, gpm	0.35 each (0.7 total)		
1.5	Discharge head (TDH)	200		
1.6	Required total head, with 5% margin:	231		
1.7	Specific Gravity, ref 60°F:	0.929		
1.8	Site Barometric Press; mmHg	740 @ 750' / AMSL		
1.9	Viscosity at Design Temp, cp	0.125		
1.11	Design Temperature °F:	70		
1.12	Range, Min to Max, gpm	0.1 – 0.35		
1.13	Suction Pressure, psig	ATM		
1.14	Available NPSH/ ft Water reference point:	4 (low level to pump cl)		
1.15	Maximum allowable shutoff Head, ft water/psig:	230 ft. / 99.6 psig		
1.16	Vapor Pressure at design Temp, psig	14.7 psig @ 124° F		
1.17	Available cooling water Temperature, °F:	NA		
1.18	Rated HP:	¼		
1.19	Installation, indoors/Outdoors	Outdoors		
2.0	**Construction Details**	Diaphragm Metering		
2.1	Impeller Material	Teflon Diaphragm Pump		
2.2	Casing Material	CS		
2.3	Shaft Material	CS		
2.4	Pump Type	Diaphragm		
2.5	Casing Split	[redacted]		
2.6	Drive Arrangement			
2.7	Base Type			
2.8	Mount Arrangement			
2.9	Rotation = Cplg end			
2.10	Pumps Identical			
2.11	Impeller Type			
2.12	***Bearing Detail***			
	Radial	[redacted]		
	Thrust			
	Bearing Lubrication			
	Bearing/ Sealing Cooling			
2.13	***Nozzle Detail***			
	Suction Location	Top	End	Bottom X
	Suction Type	Flanged	Screwed X	
	Discharge Location	Top X	Side	Bottom

	Discharge Type	Flanged	Screwed X	
3.0	**Factory Tests**			
3.1	Performance	None X	Non witnessed	Witnessed
3.2	Hydrostatic	None X	Non witnessed	Witnessed
3.3	NPSH	None X	Non witnessed	Witnessed

Note: Proposer shall fill in this data sheet separately for ammonia unloading and transfer pumps

No unloading pumps.

Cooling Tower Data Sheet

GE AEP

Project: 031134-GE AEP Riverside (Alt.)
Location: Riverside, California
Product Type: AT Cooling Tower

Evapco, Incorporated
P.O. Box 1300
Westminster, MD, 21158, U.S.A.
410-756-2600 Fax: 410-756-6450

Selection Criteria Date: 12/02/03 Page: 1

Capacity (Tons):	3,130.40
Capacity (MBH):	46,956.000
Fluid:	Water
Flow (GPM):	5590.0
Entering Fluid Temp (F):	96.6
Leaving Fluid Temp (F):	79.8
Wet Bulb (F):	72.0

Exhaust Temp:
Drift Rate:
Fan Guard Height:
Exit Diameter:

Selection

Qty	AT Model	Capacity (Tons)	Percent Capacity
1	314-0772	3,140	100.3

All Weights, Dimensions and Technical Data are Shown per Unit

Fans: 3
Fan Motors @ HP: (3) @ 50.00

Air Flow (CFM): 613,000 (204,333/cell)

Inlet Pressure Drop (psi): 0.7
Evaporated Water Rate (gpm): 75.1

Overall Length :	71'	8.00"
Overall Width :	13'	11.25"
Overall Height :	18'	3.50"
Operating Weight (lbs):		105,720
Shipping Weight (lbs):		58,170
Heaviest Section (lbs):		12,210

Options Selected

Layout Criteria

Recommended Clearances Around Units (Feet)

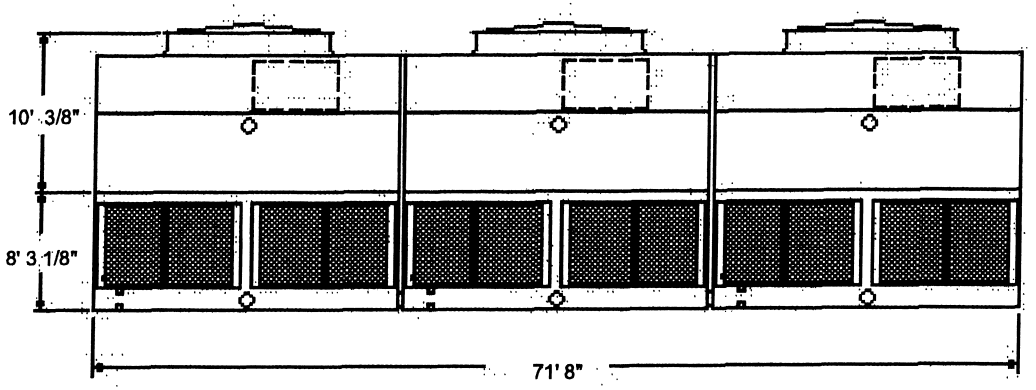
From Unit Ends to Wall:	4	Between Unit Ends:	5
From Sides to Wall:	7	Between Unit Sides:	12

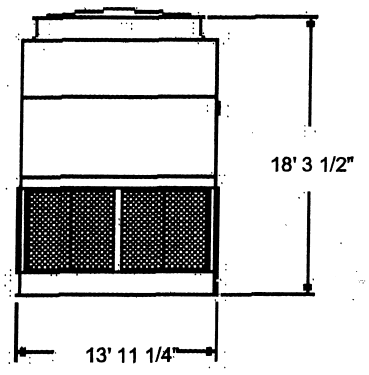
Refer to the Equipment Layout Manual or contact your Sales Representative for more details on layout criteria.

Shipping Data

Description Section		*Domestic Skidded Dimensions (in)* Length	Width	Height	Cubic Feet	Total Cubic Feet	Gross Wt (lbs)	Total Gross Wt (lbs)
Basin:	3	294	167	102	2898	8694	7,180	21,540
Casing:	3	303	167	123	3602	10805	12,210	36,630
Totals:	6				6500	19500	19,390	58,170

Shipping Notes: Ships with fan screen loose; Escorted extra wide truck





Notes:

1. Make-up water pressure 20 psi MIN. 50 psi MAX.
2. An adequately sized bleed line must be installed in the cooling tower system to prevent build-up of impurities in the recirculated water.
3. Do not use drawings for certified prints. Dimensions subject to change.
4. Height does not include fan guards. Fan guards ship loose for field mounting.
5. Outlet connection extends 3/8" beyond bottom flange.
6. Adequate spacing must be allowed for access to the cooling tower.
7. Access door swings inside unit.

Connections:

Description	Qty	Size	Type
Inlet:	3	14.0	BFW/Grooved
Outlet:	3	14.0	BFW/Grooved
Make-Up:	3	3.00	Male Pipe Thread
Drain:	3	4.00	Female Pipe Thread
Overflow:	3	4.00	Female Pipe Thread

Qty: 1	Model: **AT 314-0772**	Customer:	Project:

Capacity:

Fluid:	**Water**
Flow (GPM):	**5560.0**
Temp In (F):	**96.6**
Temp Out (F):	**79.8**
Wet Bulb (F):	**72.0**

Fan Motors:

Qty: **3** HP: **50.00**

Type: **TEAO**

Elec: **460/3/60**

Weights (lbs)

Shipping:	**58170**
Operating:	**105720**
Heaviest:	**12210**
No. Sections:	**6**

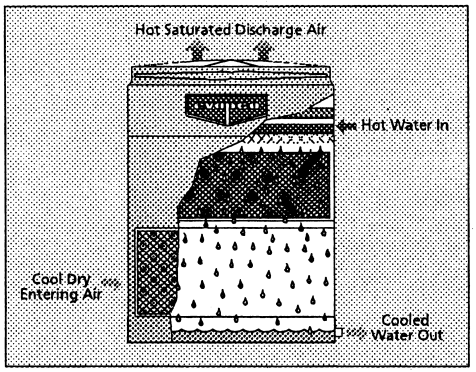
Date: **12/01/03**

P.O. Box 1300
Westminster, MD, 21158
Phone 410-756-2600
Fax 410-756-6450

AT DESIGN ADVANTAGES

The Advanced Technology Design

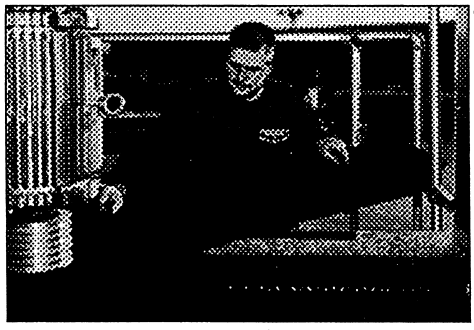
The AT Cooling Tower product line is an Advanced Technology design which utilizes induced draft, counterflow technology–the most efficient in the industry and the best design for operation in a freezing climate. The counterflow design provides the AT Cooling Tower with inherently better operational and maintenance features. These features are described below.



Principle of Operation

Warm water from the heat source is pumped to the water distribution system at the top of the tower. The water is distributed over the wet deck fill by means of large orifice nozzles. Simultaneously, air is drawn in through the air inlet louvers at the base of the tower and travels upward through the wet deck fill opposite the water flow. A small portion of the water is evaporated which removes the heat from the remaining water. The warm moist air is drawn to the top of the cooling tower by the fan and discharged to the atmosphere. The cooled water drains to the basin at the bottom of the tower and is returned to the heat source.

The vertical air discharge of the AT design and the distance between the discharge air and fresh air intakes, reduces the chance of air recirculation, since the warm humid air is directed up and away from the unit. For detailed layout information please consult EVAPCO's Equipment Layout Guidelines Bulletin 311.

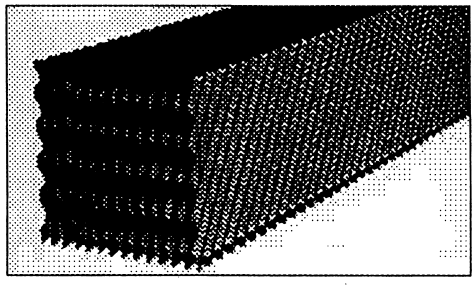


Patented** Efficient Drift Eliminators

An extremely efficient drift eliminator system is standard on the AT Cooling Tower. The system removes entrained water droplets from the air stream to limit the drift rate to less than 0.001% of the recirculating water rate.

With a low drift rate, the AT Cooling Tower saves valuable water and water treatment chemicals. The AT can be located in areas where minimum water carryover is critical, such as parking lots.

The drift eliminators are constructed of an inert polyvinyl chloride (PVC) plastic material which effectively eliminates corrosion of these vital components. They are assembled in sections to facilitate easy removal for inspection of the water distribution system.

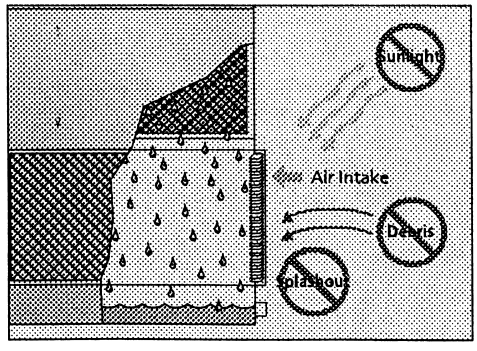


Patented* EVAPAK Fill

The patented EVAPAK® fill design used in the AT Cooling Tower is specially designed to induce highly turbulent mixing of the air and water for superior heat transfer. Special drainage tips allow high water loadings without excessive pressure drop. The fill is constructed of inert polyvinyl chloride, (PVC). It will not rot or decay and is formulated to withstand water temperatures of 130°F (55°C). Because of the unique way in which the crossfluted sheets are bonded together, and the bottom support of the fill section, the structural integrity of the fill is greatly enhanced, making the fill usable as a working platform.

The fill selected for the AT Cooling Tower has excellent fire resistant qualities. AT Cooling Tower fill has a flame spread rating of 5 per ASTM-E84-81a.

A higher temperature fill is available for water temperatures exceeding 130°F (55°C). Consult your EVAPCO representative for further details.



Superior Air Inlet Louver and Screen Design

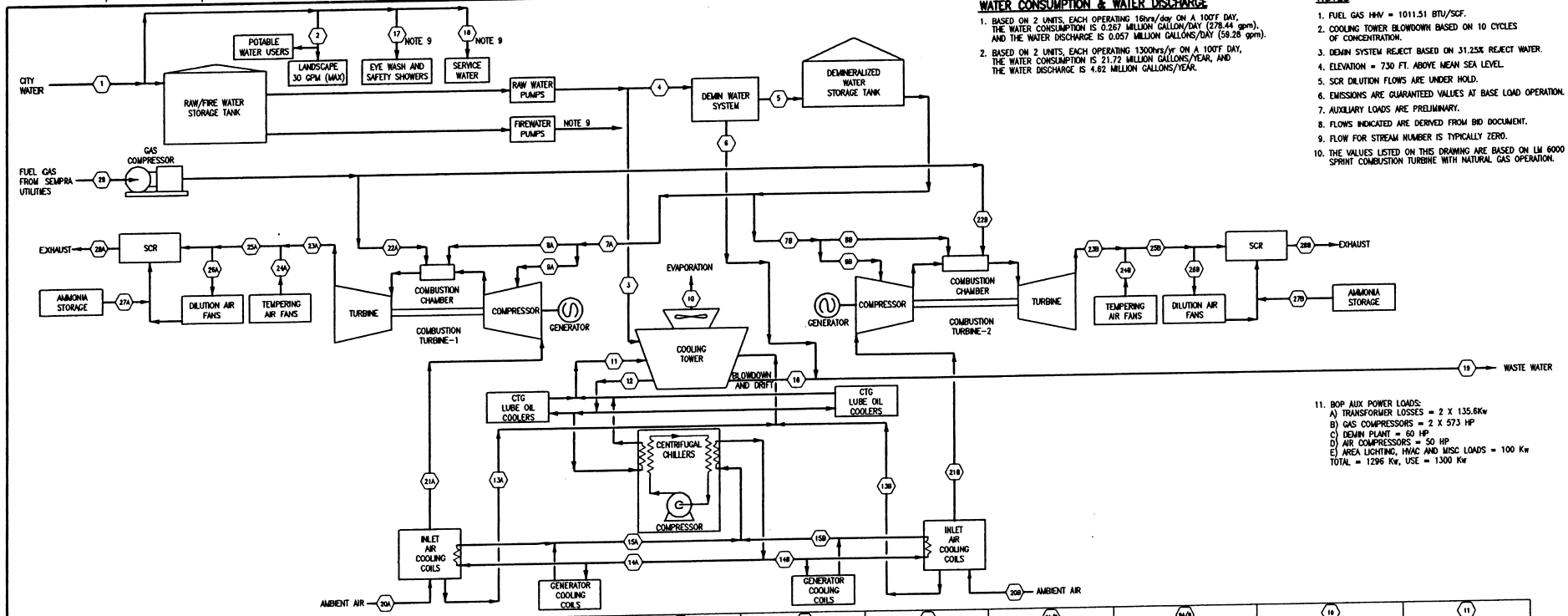
The air inlet louver screens on the AT are constructed of corrosion-free PVC. They are a two pass design that minimizes splashout and reduces the potential for algae formation inside the tower.

In single pass louver systems used by other manufacturers, circulating water droplets tend to splashout, especially when the fans are shut off. With the two pass louver system, the water droplets are captured on the inward sloping pass, minimizing splashout problems.

This unique louver design completely encloses the basin area. Direct sunlight is blocked from the water inside the cooling tower, thereby reducing the potential of algae formation. Water treatment and maintenance costs are substantially reduced.

While effectively containing the recirculating water and blocking sunlight, the louver design has a low pressure drop. The low pressure drop results in lower fan energy consumption, which reduces the operating costs of the cooling tower.

*U.S. Patent No. 5,124,087
**U.S. Patent No. 6,315,80481



WATER CONSUMPTION & WATER DISCHARGE

1. BASED ON 2 UNITS, EACH OPERATING 16hrs/day ON A 100°F DAY, THE WATER CONSUMPTION IS 0.267 MILLION GALLON/DAY (278.44 gpm), AND THE WATER DISCHARGE IS 0.057 MILLION GALLONS/DAY (59.28 gpm).
2. BASED ON 2 UNITS, EACH OPERATING 1300hrs/yr ON A 100°F DAY, THE WATER CONSUMPTION IS 21.72 MILLION GALLONS/YEAR, AND THE WATER DISCHARGE IS 4.62 MILLION GALLONS/YEAR.

NOTES

1. FUEL GAS HHV = 1011.51 BTU/SCF.
2. COOLING TOWER BLOWDOWN BASED ON 10 CYCLES OF CONCENTRATION.
3. DEMIN SYSTEM REJECT BASED ON 31.25% REJECT WATER.
4. ELEVATION = 730 FT. ABOVE MEAN SEA LEVEL.
5. SCR DILUTION FLOWS ARE UNDER HOLD.
6. EMISSIONS ARE GUARANTEED VALUES AT BASE LOAD OPERATION.
7. AUXILIARY LOADS ARE PRELIMINARY.
8. FLOWS INDICATED ARE DERIVED FROM BID DOCUMENT.
9. FLOW FOR STREAM NUMBER IS TYPICALLY ZERO.
10. THE VALUES LISTED ON THIS DRAWING ARE BASED ON LM 6000 SPRINT COMBUSTION TURBINE WITH NATURAL GAS OPERATION.
11. BOP AUX POWER LOADS:
    A) TRANSFORMER LOSSES = 2 X 135.6Kw
    B) GAS COMPRESSORS = 2 X 573 HP
    C) DEMIN PLANT = 60 HP
    D) AIR COMPRESSORS = 50 HP
    E) AREA LIGHTING, HVAC AND MISC LOADS = 100 Kw
    TOTAL = 1296 Kw, USE = 1300 Kw

STREAM NO.	1				2				3				4				5				6				7A/B				8A/B				9				10				11			
CASE	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
FLOW RATE (LB/HR)	139,220	156,535	119,980	71,570	15,000	15,000	15,000	–	43,200	60,515	23,960	1,375	81,020	81,020	81,020	70,195	55,702	55,702	55,702	48,258	25,320	25,320	25,320	21,935	27,851	27,851	27,851	24,129	22,980	22,980	22,980	24,129	4,881	4,881	4,881	0	38,880	54,465	21,580	1,240	2,250,000	2,250,000	2,250,000	120,000
FLOW RATE (GPM)	278.44	313.07	239.96	143.14	30	30	30	–	86.4	121.03	47.92	2.75	162.04	162.04	162.04	140.39	111.40	111.40	111.40	96.52	50.64	50.64	50.64	43.87	55.70	55.70	55.70	48.26	45.92	45.92	45.92	48.26	9.78	9.78	9.78	0	77.76	108.93	43.12	2.48	4,500	4,500	4,500	240
TEMP (F)	75	75	63	50	75	75	63	–	75	75	63	50	75	75	63	50	75	75	63	50	75	75	63	50	75	75	63	50	75	75	63	50	75	75	63	50	–	–	–	–	96.2	105.3	86.52	60

STREAM NO.	12				13A/B				14A/B				14A/B				15				16				17				18				19				20A/B				21A/B			
CASE	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
FLOW RATE (LB/HR)	2,250,000	2,250,000	2,250,000	120,000	980	710	3,700	0	1,312,820	1,624,163	851,479	–	1,312,926	1,624,163	851,479	–	4,320	6,050	2,400	135	0	0	0	0	0	0	0	0	29,640	31,570	27,720	22,070	1,008,767	1,008,767	1,009,131.6	HOLD	1,008,767	1,008,767	1,009,131.6	1,074,475.91	20,117.7	20,118.12	20,118.4	20,059.09
FLOW RATE (GPM)	4,500	4,500	4,500	240	1.96	1.42	7.4	–	2,626	3,248.3	1,903	–	2626	3,248.3	1903	–	8.64	12.1	4.80	0.27	0	0	0	0	0	0	0	0	59.28	62.74	55.44	44.14	–	–	–	–	–	–	–	–	–	–	–	–
TEMP (F)	80	84	74.8	50	75	75	60	–	36	38	36	–	47	47	47	–	80	84	74.8	50	75	75	63	50	75	75	63	50	75.73	76.74	64.02	50	100	115	72.2	18.0	46	46	46	32	250	250	250	250

STREAM NO.	23A/B				24A/B				25A/B				26A/B				27A/B				28				29			
EMISSIONS CASE	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
FLOW RATE (LB/HR)	1,856,736	1,856,736	1,857,101	1,118,654	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	99	99	99	99	HOLD	HOLD	HOLD	HOLD	40,235.4	40,236.2	40,236.8	40,118.18
FLOW RATE (GPM)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TEMP (F)	828.1	828.1	828.1	761.2	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	HOLD	–	–	–	–	HOLD	HOLD	HOLD	HOLD	75	75	75	75
NOx, PPMVD, 15% O2	25	25	25	25													–	–	–	–	2.5	2.5	2.5	2.5	–	–	–	–
NOx, PPH	42	42	42	42													–	–	–	–	4.2	4.2	4.2	4.2	–	–	–	–
CO, PPMVD, 15% O2	40	40	40	60													–	–	–	–	6.0	6.0	6.0	6.0	–	–	–	–
CO, PPH	40	40	41	60													–	–	–	–	6.1	6.1	6.1	6.0	–	–	–	–
PM 10 PARTICULATES	–	–	–	–													–	–	–	–	3.0	3.0	3.0	3.0	–	–	–	–
NH3 SLIP, LB/HR PPMVD 15% O2	–	–	–	–													–	–	–	–	5.0	5.0	5.0	5.0	–	–	–	–

PERFORMANCE SUMMARY

CASE	I	II	III	IV
COMBUSTION TURBINE Kw/UNIT	49,800	49,800	49,800	50,454
NUMBER OF CTG'S	2	2	2	2
TOTAL GROSS OUTPUT, Kw	99,600	99,600	99,600	100,908
CTG AUX POWER/LOSSES, Kw	2,818	3,298	2,250	964
BOP AUX POWER AND GSU TRANSFORMER LOSSES Kw	1,300	1,300	1,300	1,300
NET PLANT, Kw	95,482	95,002	96,050	98,644
FUEL INPUT/UNIT MMBTU/HR (LHV)	425.55	425.559	425.565	424.31
TOTAL FUEL INPUT/MMBTU/HR (LHV)	851.10	851.12	851.13	848.62
NET PLANT HEAT RATE				
BTU/KWH (LHV)	8,913.72	8,958.87	8,861.32	8,602.85
BTU/KWH (HHV)	9,849.66	9,899.66	9,791.76	9,506.15

CASE
I = SUMMER DESIGN, 100°F DBT, 68°F WBT, 19% RH
II = MAX SUMMER, 115°F DBT, 72°F WBT, 12% RH
III = AVERAGE ANNUAL, 72.2°F DBT, 62.8°F WBT, 60% RH
IV = WINTER DESIGN, 18°F DBT, 18°F WBT, 100% RH

INTER-DISCIPLINE REVIEW

DISC	ARCH	CIVIL	ELECT	HVAC	I&C	MECH	STRUCT
DATE	–	9/5/03	9/5/03	–	9/5/03	9/5/03	9/5/03
INIT	–	WKW	LT	–	MAC	PR	KL

REV	REVISIONS	DATE	DRN	DSGN	CKD	APPD
A	ISSUED FOR BID	2/12/04	JAB	PR	JPB	JPB
A	ISSUED FOR REVIEW	1/26/04	JAB	PR	JPB	JPB
A	ISSUED FOR REVIEW	10/21/03	CEA	PR	JPB	DT
A	ISSUED FOR REVIEW	9/5/03	JAB	PR	JPB	DT

REFERENCE DRAWINGS

DSGN	PR	7/19/02
DRN	JAB	8/29/03
CKD	JPB	9/5/03

SCALE: NONE

FOR 22x34 DWG ONLY

POWER ENGINEERS

RIVERSIDE PUBLIC UTILITIES
RIVERSIDE ENERGY RESOURCE CENTER
PROCESS FLOW DIAGRAM

JOB NUMBER 101414
REV A
DRAWING NUMBER M2-1

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