Energetech, LLC

Power Generation Equipment Supplier

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LM1500- Gas Turbine
Power Generation Package

STANDARD EQUIPMENT	*OPTIONS*
LM1500A Gas turbine	Water wash system
Reduction gearbox (as required)	Inlet cooling
Electric generator	Anti-icing system
Inlet air filtration system	Fuel gas compressor system
Inlet air silencer	HRSG
Fuel (liquid or gas) system	Oil debris monitor system
Hydraulic start system	Individual EGT readout system
GT lube system	O&M program
Control system	Remote control monitoring
Fire/gas detection system	Training course
O&M manuals	

RATINGS:

Power Output @ ISO Conditions	10 MW continuous & 11.5 MW peak
Btu/shp-hr	7,800
Btu/kW-hr (LHV)	12,000
Exhaust Gas Temperature	800° F.
Exhaust Gas Flow	160 lb/sec
Power Turbine Speed	5,500 rpm
Shaft Horse Power	15,500
Fuel requirements	Distillate and/or Natural Gas
Power Factor	0.8 (Typical)
Gas Generator	17 Stage Compressor – 3 Stage Turbine
Power Turbine	Single Stage

MAJOR EQUIPMENT SUPPLIERS:

Gas Turbine	Modified G.E. LM1500
Generator	Ideal Electric or equivalent
Inlet/Exhaust system	Universal Silencer or equivalent
Controls	GE Global or equivalent
Reduction gearbox	Lufkin Gears or equivalent

Last Update: 11/14/2001

Section 1 – Overview

Energetech LLC is pleased to announce a working relation with a packager that proposes to supply one (1) turbine-generator package which will consist of the equipment itemized in the accompanying equipment list (Section 2) and as detailed below. The unit proposed will be complete, fully tested, ready to run and generate power

It is proposed that the components will be shipped as nearly complete as possible. The turbine assembly will be shipped as one unit, complete from the bellmouth on the air intake end to the power turbine on the drive end. The coupling, gear box and generator will be shipped as a skid-mounted assembly, with the gas turbine mounted on a separate assembly. The control system cabinet and, lubrication/starter skid will be shipped as loose components to be integrated at site. A weather resistant sound enclosure will be provided for the complete turbine-generator skid (the control cabinet will need to be housed in building; other skids are weatherproof). Also provided will be intake air filter/silencer assembly and exhaust assembly.

The package will include a spare gas generator (gas jet engine) during the warranty period which can be installed within 4 hours to replace an engine that may have failed during warranty. The failed engine will be reworked under warranty and provided back to site for reinstallation at a convenient opportunity.

Section 2 – Equipment List

Base Proposal – One Unit

Item Qty. Description

1. 1 LM1500A Gas turbine – complete with the following equipment:
   - Bellmouth
   - Bullet nose
   - Gas turbine complete with fuel nozzles and manifolds for natural gas firing (#2 Diesel firing available with optional equipment)
   - Power turbine
   - Lubrication system components
     - Lube supply manifold
   - Instrumentation:
     - (2) Gas turbine speed sensors (magnetic pickup type)
     - (2) Power turbine speed sensors (magnetic pickup type)
     - (11) Power turbine inlet temperature probes (Chromel/Alumel type)
     - (1) Gas generator vibration sensor (accelerometer type)
     - (1) Power turbine vibration sensor (accelerometer type)
     - (1) Oil supply temperature sensor (RTD single-element type)
     - (5) Oil scavenge temperature sensors (RTD single-element type)
     - (1) Lube oil supply pressure sensor
     - (1) Scavenge oil pressure sensor
     - (2) Pressure sensors for compressor discharge pressure
     - (1) Power turbine inlet pressure sensor
   - Single ignition system (ignitor, high-tension cable, exciter)
   - Inlet screen kit
   - Air intake assembly with air filter system assembly and silencers; exhaust stack with silencers
   - Weather/sound enclosure (fire and gas detection systems included in gas turbine enclosure)
   - Fire detection/suppression system (for gas turbine enclosure)
   - Gas detection system (for gas turbine enclosure)
   - Gas turbine skid and separate generator/gearbox skid

2. 1 Gearbox and coupling:
   - Lufkin Gears (or equivalent) parallel horizontal offset gear box designed for input speed of 5500 rpm and output speed of 1800 rpm
   - Coupling Corporation of America Flexxor 400C (or equivalent) high speed diaphragm coupling

3. 1 Generator
   - Ideal Electric (or equivalent) “SAB” horizontal brushless air-cooled AC generator rated for 13.8 KV @ 60 Hz (1800 rpm); with integral lube system
   - Voltage regulator cabinet (NEMA 12)

4. 1 Control package
   - Turbine monitoring and control package based on MicroNet Series (or equivalent) control system with non-redundant processor
   - NEMA 12 cabinet housing vibration monitor and control system
   - Vibration monitor
   - Synchronizer
   - Gas shutoff, control and vent valves (to be piped at site)
   - Diesel shutoff and control valves (optional; to be piped at site)

5. 1 Lube system and starter skid
   - Lube oil reservoirs, duplex filters, pumps, local indicators, temperature regulation, cooler
   - Electric/hydraulic starter system
   - On-board motor starters

6. LOT Switchgear
   Unit will be supplied with 1000A 3ϕ isolation breaker cubicle complete with generator protection relays, power monitoring displays. Second cubicle to contain ground fault protection equipment.

7. 1 Documentation Package
   - Installation Design Manual
   - Operation and Maintenance Manuals (LM Alternatives will provide O&M manual for gas turbine; vendor packages will be provided for buy-out equipment)

8. LOT 480 VAC Power Distribution Center.
   Power distribution center to be supplied for isolating disconnects of all auxiliary skid motors, enclosures, etc.

Section 3 – Clarifications

Technical

1. Reliable operation and low maintenance costs for the gas turbine require that the installation designs and operating/maintenance practices be in accordance with the instructions defined in the system drawing packages and the Operation and Maintenance manual.

2. In order to minimize vibration and misalignment, it is anticipated that suitable concrete pads will be available for anchoring the components. Main skid is approximately 52' long by 11' wide; auxiliary skids are approximately 10' long by 6' wide.

3. Components selected by the factory have been designed for precise engineering match to achieve specific performance criteria. Engineering submittals are mainly for information only and customer review. Due to time constraints of the project, submittal will be assumed to be complete and purchasing will commence ten (10) working days after submittal. Substitution of components at customer request can be accommodated upon execution of change order and may entail revision of delivery schedule.

4. Final configuration of spare parts package and pricing will be provided after engineering details are completed and configuration finalized.

5. In order to maintain optimum performance of the gas turbine, fogger skids are recommended for areas where ambient temperatures during Spring, Summer and Fall may exceed 80ºF.

6. Final selection of air inlet filter media will be determined after further details from the site are provided regarding dust loading in the area. Special filters may impact final pricing. Optional system is proposed with passive filtration

7. Incoming natural gas pressure will be required at constant 275 $\pm$ 25 psig. Fuel compressor is available as an option to boost to needed pressure. Fuel quality is assumed to be at least 19000 Btu/lb (LHV) and PUC grade.

8. It is assumed that control will be done locally through the operator stations supplied in the shelter. MODBUS interface is available but integration on plant side will be by others and may cause delay in start-up.

9. Locally required compliance (for example, fire suppression, ammonia leak monitoring) or other requirements not identified are excluded.

10. Permits (construction, environmental, etc.) excluded.

11. Unit performance is 10,000kW (simple cycle) with peaks to 11,300kW.

12. NO_x emissions are approximately 40 ppm firing natural gas and 70 ppm firing #2 Diesel based on full load firing. CO emissions are approximately 95 ppm. With optional SCR, emission levels can be reduced to 5 ppm NO_x, 10 ppm CO, with 10 ppm NH3 slip.

13. Factory recommends for units with less than 100 starts/year an annual inspection. Oil filters, depending upon severity of climate, may need to be changed every 6 months. LM Alternatives proposes to conduct training classes for operations and maintenance staff. The units are designed for automatic start-up through the digital control system, requiring minimal input from operators.

14. Routine maintenance costs will include replacing oil filters and lubricating fluids consumed during operation. Estimated costs for oil filters are $1200 annually; lubrication fluids should be approximately $100/month. Unless the dust loading is extremely severe, the air filters should require replacement bi-annually.

    Time between major overhauls is typically 40,000 hours firing natural gas and 25,000 hours firing #2 Diesel. Annual inspection of the hot sections of the engine are recommended for units with less than 100 starts/year. Quarterly inspections of the hot sections of the engine are recommended for units with starts exceeding 100/year.

15. Noise level shall be maintained at 85dB @ 3 meters in compliance with OSHA standard regulations.

16. Training of plant personnel will occur informally during start-up and commissioning of first unit unless separate training is purchased.

17. Final price may be adjusted if, upon finalization of details regarding existing electrical system and tie-in, additional equipment is found to be necessary.

18. During the course of the warranty period, a service engine will be placed on site in a shipping container to minimize downtime should there be a component failure on the engine. The changeout requires approximately 4 hours after engine cool down (about 2 - 4 hours) and can be accomplished with routine hand tools.

19. If protective relay and switchgear is supplied by others, it must meet technical requirements and approval of LMA.

20. While isolation switchgear, synchronization systems and protective relays and other necessary components are provided as part of this quotation, final price may be adjusted if, upon finalization of details regarding existing electrical system and tie-in, additional equipment is found to be necessary.

Section 4 – Commercial

Terms and Conditions

This proposal is based on the attached terms and conditions.

Validity

Pricing is firm based on proposed configuration.

Delivery

Delivery of unit can be 4 to 5 months depending on options needed and factory production.

Freight

Pricing is FOB factory location for all equipment.

Warranty

Equipment is warranted to satisfy performance criteria for a period of twelve (12) months (or 8000 operating hours) from first firing or eighteen (18) months after shipment, whichever occurs first. See warranty statement in terms and conditions of sale attached for further details.

Payment Terms

The following payment terms will apply; payable within thirty (30) days of invoice (down payment must accompany notice to proceed or purchase order before work will proceed; once down payment received, final delivery date will be confirmed) drawn on irrevocable letter of credit from a bank acceptable to the Factory:

40%	Down payment upon notice to proceed
30%	Upon drawing submittals (drawing list attached with proposal)
20%	Upon completion of acceptance test
10%	Upon shipment to site

Acceptance Test

Reduction gear box and AC generator are tested individually at each factory to verify performance and tested as an assembly at AC generator factory before final shipment.

Gas turbine is tested at Packager's test facility to verify proper mechanical operation and compliance with guarantee performance levels. Testing is in conformance with Packager's ISO established test procedures for industrial gas turbines (copy is available upon request). Test reports will be provided as part of final documentation package.

Service and Training

Field service for installation, start-up and commissioning is available at per diem rates or can be provided as lump sum extra as part of the contract.

Training can be provided either at site or at Packagers factory. Two types of training are available: operations; technical. Operations training normally is five days; class size limited to 10 individuals. Technical training is normally ten (10) days; class size is limited to five (5) individuals. Training can be provided on per diem basis or as lump sum price (please contact Field Service Department directly for quotation).

Annual Maintenance program provides up to 4 site service calls annually for a total of 64 man-hours with guaranteed 24 hour response to site for emergencies. As long as the program is in place, the factory will honor a 15% discount against spare parts prices while the warranty is in place. It will also honor a reduced daily service rate (normal 8-hour day) from $960/day to $800/day. Travel and living expenses to be billed at cost plus 5% handling fee.

Section 5 – Pricing Summary

BASE PRICE – (for purchase of one 10 MW unit as outlined in the Base Equipment List)

TOTAL FIRM PRICE: Please Call

Optional Equipment

Power/Control Building:

De-Icing System:

Fogging System: 7.5 gallons of demineralized water is required.

Water Wash System:

Dual Fuel:

Extended Warranty:

Annual Maintenance Program:

TERMS AND CONDITIONS OF SALE

GENERAL
This document together with any additional documentation signed by Seller and Buyer represents the Agreement between the parties. These terms may not be modified except in writing signed by an authorized representative of Seller. Any terms and conditions submitted in Buyer's inquiry or purchase order shall be null and void unless specifically agreed to by a writing signed by an authorized representative of Seller. Catalogs, circulars and similar pamphlets of Seller are provided for general information purposes only and are not a part of the Agreement. Except as expressly contained herein no representation or warranty is made as to performance, size, durability, or other specifications of Sellers products and any information contained in catalogs, circulars and similar promotional or advertising material is for general informational purposes only.

TAXES/DUTIES
Any sales, use or other similar type taxes or import or export duties imposed on this transaction are not included in the price. Such taxes and/or duties shall be billed separately to Buyer. Seller will accept a valid exemption certificate from Buyer if applicable; however, if such exemption certificate is not recognized by the governmental taxing authority involved and Seller is required to pay the tax covered by such exemption certificate, Buyer shall promptly reimburse Seller for the taxes paid.

EXCUSABLE DELAYS
Seller shall not be responsible for nonperformance or delays in performance occasioned by any causes beyond Seller's reasonable control, including, but not limited to labor difficulties, delays of vendors or carriers, Seller's prompt receipt of Buyer's equipment, Seller's compliance with Buyer's change orders, fires, acts of God, war, non-governmental actions and material shortages. Any delays occasioned by such circumstances shall affect a corresponding extension of Seller's performance dates.

DELIVERY, TITLE AND RISK OF LOSS
Completion dates are approximate, and are based upon prompt receipt of approvals, receipt of equipment from Buyer or vendors (as may be appropriate), or otherwise prompt receipt of all necessary information. Unless otherwise specified by Seller, all shipments are F.O.B., Seller's facility. Full risk of loss (including transportation delays and losses) shall pass to Buyer upon delivery of products to the F.O.B. point, or if Seller consents to a delay in shipment at the request of Buyer, risk of loss shall pass to Buyer upon notification by Seller that the products are ready.

WARRANTY
Seller warrants that equipment supplied by it and delivered hereunder will be free from defects in materials and workmanship, and will meet all specific requirements, if any, of this agreement. Seller warrants its own equipment for a period of twelve (12) months from installation and all claims for defective parts under this warranty must be made in writing immediately upon discovery, and in any event, within eighteen (18) months from shipment of the applicable item whichever shall first occur. Upon Buyer's submission of a claim as provided above and its substantiation, Seller shall at its option either (i) repair Buyer's equipment at the original F.O.B. point of delivery, (ii) refund an equitable portion of the contract price, (iii) furnish F.O.B., Seller's facility or other point of shipment any necessary repaired or replacement parts. Small components, such as lights, switches, fuses, that can reasonably be replaced by Buyer's maintenance staff shall be provided F.O.B. site. Defective items must be held for Seller's inspection and returned to the original F.O.B. point upon request.

With respect to parts not manufactured by Seller, Seller assigns to Buyer whatever warranty Seller receives from the Supplier of such parts or services. However, Seller agrees to be Buyer's primary contact on all warranty claims.

The foregoing warranties are exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY.

Seller makes no performance warranty unless specifically agreed to elsewhere and the effects of corrosion, erosion and normal wear and tear are specifically excluded from Seller's warranty.

Seller will not be liable to Buyer for any loss or injury to persons or property (including the machinery which is the object of the work) caused in whole or in part by (1) the acts of Buyer or its agents, (2) failure to observe Seller's instructions, or (3) failure or malfunctioning of anything not furnished by Seller.

The preceding paragraphs set forth the exclusive remedies for warranty claims, and upon the expiration of the warranty period, all such liability shall terminate.

PAYMENT TERMS
Payment terms are as indicated in the proposal. Invoiced milestone payments are due within thirty days of invoice date. If the order is placed from outside the United States, an irrevocable letter of credit will be required, drawn on a bank acceptable to Packager for the amount of the order. Payment will be drawn against the letter of credit. Payment received thirty days after the invoice date is subject to interest charges at the maximum allowable rate as provided by applicable law.

LIMITATION OF LIABILITY
Seller shall in no event be liable to Buyer or any successor for any consequential, incidental, or indirect damages arising out of this Agreement or any breach thereof, including but not limited to damages resulting from: loss of use, profits, revenue, interest or goodwill; work stoppage, impairment of other goods, shutdown or non-operation, increased expenses of operation; cost of purchase of replacement power, or claims of Buyer or customers of Buyer for service interruption whether or not such loss or damage is based on contract, indemnity, tort, product or strict liability or otherwise.

> **THE REMEDIES OF BUYER SET FORTH HEREIN ARE EXCLUSIVE. THE TOTAL LIABILITY OF SELLER WITH RESPECT TO THE PERFORMANCE OR BREACH OF THIS AGREEMENT WHETHER BASED ON CONTRACT, INDEMNITY, TORT, PRODUCT OR STRICT LIABILITY OR OTHERWISE, SHALL NOT EXCEED THE CONTRACT PRICE OF THE AGREEMENT OR THE PART UPON WHICH SUCH LIABILITY IS BASED.**

ASSIGNMENT
Neither party shall assign or transfer this Agreement without the prior written consent of the other party, which shall not be unreasonably withheld.

GOVERNING LAW
The rights and obligations of the parties shall be governed by the laws of the State of California, excluding conflict of laws provisions.

NUCLEAR LIABILITY
If the services are to be performed in a nuclear facility, Buyer shall arrange for insurance and governmental indemnity against liability. Buyer holds harmless and indemnifies Seller and its suppliers for any damage, including loss of use, in any manner arising out of a nuclear incident, even if due in whole or in part to the negligence of Seller or its suppliers.

MATERIAL DATA SHEETS
Buyer shall supply to Seller the required Material Data Sheets (MSDS) per Federal Regulation 29CFR1910.1200 Hazardous Communications for each hazardous material substance with which Seller's employees may have contact in the course of their work assignment,

LMA 1500 Emission Values[1]

Note: Values are on a per turbine basis					
		Natural Gas	#2 Diesel	Natural Gas	#2 Diesel
Pollutant	Units	Uncontrolled numbers		Controlled numbers	
NOx		40	70	2.5	2.5
	#/MMBtu	0.1661	0.2949	0.0104	0.0105
	tons/yr	83.8	146.6	5.2	5.2
CO		95	95	10	10
	#/MMBtu	0.3945	0.4003	0.0415	0.0421
	tons/yr	199.0	199.0	20.9	20.9
PM10	#/MMBtu	0.0066	0.0120	0.0066	0.0120
	tons/yr	3.3	6.0	3.3	6.0
SO2	#/MMBtu	0.0034	0.0033	0.0034	0.0033
	tons/yr	1.7	1.6	1.7	1.6
NH3	#/MMBtu			0.0415	0.0421
	tons/yr			20.9	20.9
VOC	#/MMBtu	0.0021	0.0004	0.0021	0.0004
	tons/yr	1.1	0.2	1.1	0.2

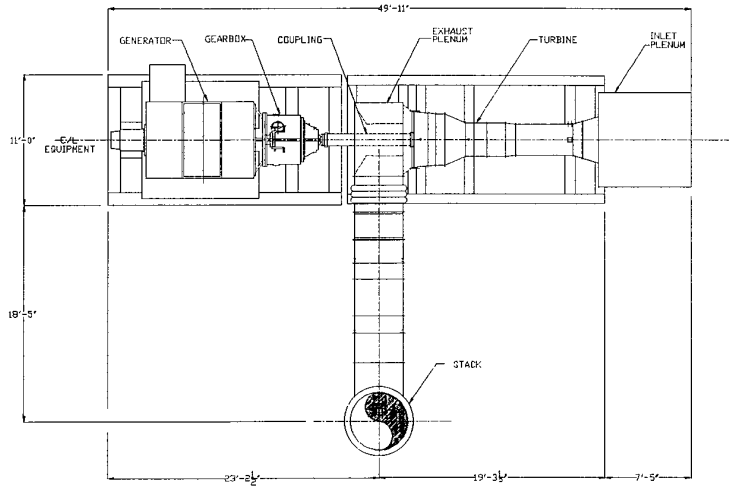
[1] Reductions are typical based on SCAQMD BACT requirements. Assumes 8000 hrs/year firing.

WARRANTY PROGRAM

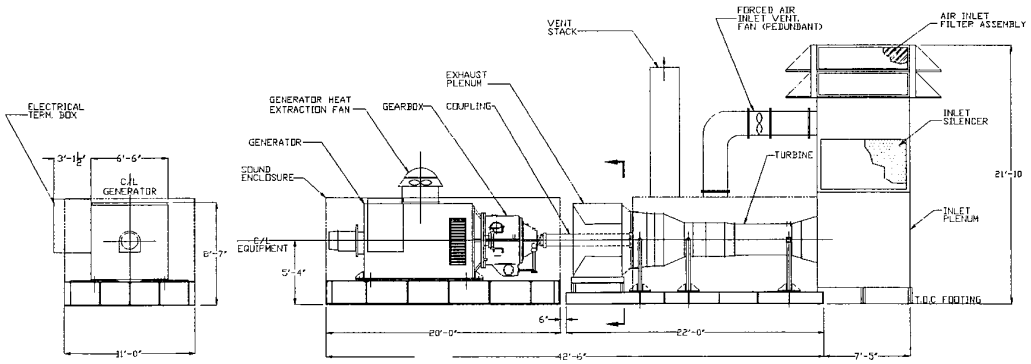
The Factory offers a complete warranty program for the entire package it provides. Term is 12 months (8000 hours) from first firing or 18 months from shipment. This includes the new equipment provided (i.e., generator, gearbox, control system, etc.), which carries transferable factory warranties, as well as the refurbished engine and power turbine. Typically small components (lights, fuses, filters and switches) which can be replaced by plant staff are supplied shipped loose. Major repairs (control system, gearbox, generator) are performed by factory service technicians.

The warranty program covering the engine is unique in that during the course of the standard warranty, the Factory will provide one engine on-site (a service engine) as a replacement engine should the purchased engine(s) fail. This minimizes downtime for the end user since the engine can be replaced and the service engine installed in 4 to 6 hours after cool down. The failed engine is not repaired at site but is immediately returned to the factory. A refurbished engine in the manufacturing cue will be sent to the site as a replacement for swapping out during the next normal outage/inspection cycle. The Factory's customer service concept is to minimize the end user's inconvenience and maximize his uptime.

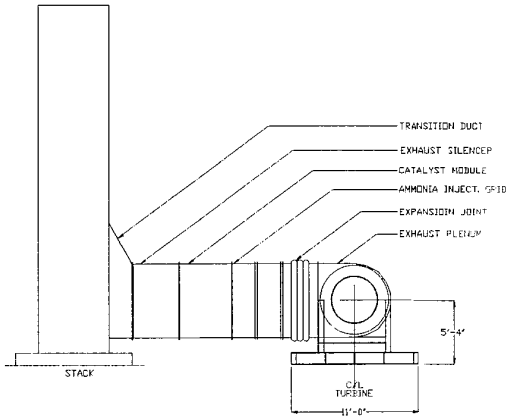
Extended warranty coverage on the engines beyond the initial term is also available. For an annual fee per engine (slightly higher for engines firing #2 diesel), the Factory will leave a fully refurbished engine on-site as long as the warranty payments are current. Any time during the active period an engine fails, a replacement will be provided. The added advantage is that should the program be in place during the course of the engine's normal 40,000 hour (for natural gas firing) maintenance cycle (25,000 hours on engines firing #2 diesel), the initial engine(s) will be replaced with refurbished engines rather than sending the initial engine(s) out for service or servicing on-site (labor to remove/install are excluded from price). Thus once again, the Factory provides a superior service to minimize the end user's inconvenience and downtime. After the initial engines are replaced, so long as the warranty is current, a refurbished engine is kept on site in canister.



PLAN VIEW



FRONT VIEW - ELEVATION
(STACK NOT SHOWN IN THIS VIEW FOR CLARITY)



GENERAL DATA

GAS TURBINE

Model:	GE. LM 1500
Cycle:	Simple
Fuel:	Natural Gas (Distillate or #2 Diesel Option)
Starting Sytem	Hydraulic Start System
Shaft Horse Power:	15,400
Weight:	3,000 lbs.

GENERATOR

Type:	"SAB" Horizontal Brushless Air Cooled
Rated:	12,500 KVA, 60 Hz, 1800 RPM, 13,800 V
Exitation:	Field suitable Brushless Exciter-Regulator
Lube Oil System	Separated Integrated Lube System
Weight:	51,830 lbs.

GEARBOX & COUPLING

Gearbox Type:	Epicyclic
Input/Output Speed, RPM	5500/1800
Gearbox Weight:	7110 lbs.
Coupling Type:	High Speed Diaphragm Type
Weight:	

PERFORMANCE (ISO Condition)

Power Turbine Speed	5500
Exhaust Flow, lbs/sec	162
Power Turbine Temp., °F	800 °F (101 MMBTU/HR Exhaust @ 500°F drop)
Generator Output, KW	10,000 (11,500 peak)
Generator Efficiency	0.973

Total Weight of Unit	110,000 lbs

NOTES:
1. WORK THIS DWG. WITH DWG No. CA994218, SHT. 2 OF 2.
2. SOUND ENCLOSURE NOT SHOWN FOR CLARITY.

REVISIONS			
REV	DESCRIPTION	BY	DATE

SCALE: NONE	SHEET: 1 OF 2	CM PROJECT NO.: 257	

(DWG SCALE SET-UP: 1/4"=1'-0")

DATE: 1-8-2001	CUSTOMER
DESIGNED BY: LCZ	
DRAWN BY: LCZ	TITLE: 10 MW AERODERIVATIVE GENERAL ARRANGEMENT
CHECKED BY: MK	
APPROVED BY: MK	SIZE: D; DRAWING No.; REV: 0

Reference: Job No. 04017