

GE PACKAGED POWER, INC.
CONTRACT

FOR U.S. BASED SALE OF
EQUIPMENT & SERVICES

MMC Energy Inc
Chula Vista
Energy Upgrade Project

25 January 2008

Contract For U.S. Based Sale of Equipment and Services

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Contract For U.S. Based Sale of Equipment and Services

THIS AGREEMENT ("Contract") is entered into as of the Effective Date by and between:

GE PACKAGED POWER, INC., a Delaware corporation, having a principal place of business at 1333 West Loop South, Houston, Texas 77027 USA (the "Seller"); and MMC Energy, Inc., a New York corporation, having a principal place of business at 26 Broadway, Suite 960, NY, NY, 10004 (the "Purchaser").

The Purchaser and the Seller are referred to herein individually as a "Party" and collectively as the "Parties".

Recitals

WHEREAS, the Seller is engaged in the business of manufacturing and delivering various kinds of power plant equipment and of providing services and training in support of the installation and use thereof; and

WHEREAS, the Purchaser desires to purchase, and the Seller desires to sell the Equipment, together with certain installation support and training Services in connection with Purchaser's Project located at 3497 Main St, Chula Vista, CA, all subject to the terms set forth herein;

NOW, THEREFORE, in consideration of the mutual promises stated herein, the receipt and sufficiency of which is hereby acknowledged, the Parties agree as follows:

Article 1 Definitions

Defined terms are set forth in Attachment 1 to this Contract.

Article 2 Scope of Supply

The Seller shall manufacture and deliver the Equipment and perform the associated Services as more fully described in Attachment 2, subject to the terms and conditions as set forth in this Contract. The Equipment includes two (2) LM6000PC classic Units and associated skids and auxiliary equipment as listed in Article 3 below.

Article 3 Price

The Purchaser shall pay to the Seller the following "Contract Price" in consideration of the Equipment and Services (except Technical Advisory Services which shall be priced accordingly to Attachment 12, and transportation which shall be priced according to Article 7.6 below):

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Description	Price EACH (USD)	QTY	EXT Price (USD)
Gas Turbine Generator Set with: Option A SPRINT® Power Augmentation Option B NO _x Control - Water Injection System	\$14,910,000.	2	\$29,820,000.
Option C Inlet Air Cooling – Evaporative Cooling	\$402,580.	2	\$805,160.
Option D Lube Oil Cooler - Fin/Fan ^{NOTE 1}	\$44,920.	2	\$89,840.
Option H DC Backup Lighting	\$18,770.	2	\$37,540.
Auxiliary Skid Enclosure	\$125,000.	2	\$250,000.

NOTE 1: Pricing shown is the ADDER to substitute the fin/fan lube oil cooler in place of the standard shell and tube cooler.

The above Contract Price includes all options known and exercised at the Contract Effective Date. The Contract Price shall be adjusted as necessary to take into account:

- (i.) Change Orders, including those related to the exercise of Options (as defined in Article 4) that may be exercised after the Contract Effective Date, and
- (ii.) Other adjustments specifically provided for in this Contract. Payment shall be made in accordance with the Payment Schedule set forth in Attachment 3 and in accordance with the payment terms and conditions set forth in Article 5 of this Contract.

Estimated Prices shown below for Technical Supervision are INDICATIVE ONLY and provided for reference based on scope described in Attachment 2 under Option AAA and on current effective rates (see Attachment 17). Actual costs to be billed based on rates in effect at time of service.

Description	INDICATIVE Estimated Price
Option AAA Technical Supervision (2-Unit Site)	\$745,700.

Article 4 Options

The Purchaser shall have the right to exercise options to purchase the additional Equipment

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or Services which have been previously and specifically quoted to Purchaser and which are described in the Attachment 4, within the times and at the prices therein stated. If any Option is exercised in writing prior to the option exercise deadline(s) set forth in Attachment 4, the Contract Price will be automatically adjusted as set forth in the Attachment 4 and the associated Payment Schedule and RTS Schedule shall be set forth in a mutually executed Change Order.

Article 5 Payments

5.1 Payment Schedule

Payments shall be made in accordance with the Payment Schedule set forth in Attachment 3 hereto. Payments shall be remitted via wire transfer in compliance with the wire transfer instructions provided on each invoice. Late payments shall be subject to an interest charge equal to two percent in excess of the prime rate as published in the Wall Street Journal, calculated from the payment due date to the date upon which the payment is actually received by the Seller.

5.2 Effect of Changes in Contract Price

If any adjustment results in an increase to the Contract Price, Purchaser shall pay for the increase in accordance with the corresponding invoice submitted by Seller. If any adjustment results in a decrease in the Contract Price, payments previously made shall be retained by the Seller and will be applied to subsequent payments as they become due.

5.3 No Offset

Seller shall not be responsible for backcharges or field modifications performed by Purchaser unless Seller authorizes such charges in writing prior to the incurrence thereof and Purchaser specifically waives any right of set-off relating to such charges. Upon written notification from Purchaser, Seller shall respond within five (5) business days with approval of the proposed modifications or with a plan for the review of the proposed modifications. Seller shall not unnecessarily withhold approval of said field modifications or unnecessarily delay the review process. Any claim or set-off for backcharges shall be accompanied by a copy of such written authorization.

In no event shall Purchaser offset any amounts due under this Contract by amounts that may be due Purchaser from Seller or any of its Affiliates under any other agreement, judgment or order.

5.4 Further Assurances

If requested by Seller at any time, Purchaser will demonstrate its financial capability to continue to carry out its obligations under this Contract. This demonstration may require that Purchaser furnish adequate payment security (which may include a letter of credit, parent guaranty or surety bond in a form and amount reasonably acceptable to Seller).

Article 6 Termination by Purchaser for Convenience

The Purchaser shall have the right to terminate this Contract, at any time for its convenience, and this termination for convenience shall be effective upon:

- (i.) Receipt by the Seller of written notice of termination
- (ii.) Receipt by the Seller of termination charges in accordance with the Termination Schedule attached to this Contract as Attachment 5. If Purchaser's payment of the termination charges occurs after Seller receives Purchaser's termination notice, Seller shall have the right to suspend performance upon receipt of the termination notice and await the payment of termination charges without penalty to Seller. Termination for Cause is addressed in Article 23 of this Contract.

Article 7 Title Transfer, Delivery, Risk of Loss, Shipment to Storage

7.1 Passage of Title

Title to each item of Equipment or materials to be shipped from within the United States to a Site within the United States shall pass to the Purchaser when the Seller issues its Notice of RTS indicating that the Equipment is available for shipment from the relevant warehouse or factory. Title to the Equipment or materials to be shipped from a country other than the United States to a Site within the United States shall pass to the Purchaser at the port of export immediately after the Equipment or materials have been cleared for export. Title to Services shall pass to the Purchaser as performed. This Contract assumes that the Site will be located in the United States. In the event that, for any reason, the Buyer proposes to use the Equipment at a Site located outside of the United States, Seller may request that the Parties enter into a written amendment of this Contract allowing for high seas title transfer.

7.2 Lien Waiver

Prior to remittance of Purchaser's final payment for the Equipment or Services, Purchaser will request that Seller issue a final (one-time) lien waiver in the form of Attachment 6 to this Contract.

7.3 Delivery and Delivery Point

If Purchaser does not elect to use transportation service described in Article 7.6 below, Seller shall accomplish Delivery of the Equipment to Purchaser at the relevant manufacturing facility or warehouse upon Notice of RTS (the "Delivery Point"). Terms of Delivery of the Seller Supplied equipment will be EX-Works, relevant warehouse or manufacturer's facility (EXW as per Incoterms 2000).

If Purchaser elects to use the transportation service described in Article 7.6 below, the Delivery Point instead shall be defined to be the Purchaser's Site, and Delivery shall be deemed to have been accomplished by Seller upon arrival of the transport carrier at the Site but prior to unloading (which shall be the responsibility of Purchaser). If this Option is selected, terms of Delivery of the Seller Supplied equipment will be Cost and Insurance Paid to Owner's jobsite (CIP as per Incoterms 2000). The Parties recognize that, in either case, Delivery may be deemed to have occurred in the event of a storage situation as set forth in Article 7.5 below.

7.4 Passage of Risk of Loss

Seller shall remain responsible for risk of loss or damage to the Equipment and materials incorporated therein until delivered to the Delivery Point (as defined above, depending upon whether Purchaser elects to use the transportation service described in Article 7.6 below or make its own transportation arrangements). If, however, Purchaser is unable to accept the Equipment upon Seller's Notice of RTS and a storage situation is triggered in accordance with Article 7.5 below, Seller shall retain risk of loss for the Equipment during the storage period only if Seller is directly responsible for storage.

7.5 Shipment to Storage

If any part of the Equipment cannot be shipped to the Purchaser when ready due to any cause not attributable to the Seller, the Seller may ship such Equipment to storage. If the Equipment is placed in storage, including storage at the facility where it is manufactured, the following conditions shall apply:

- (i.) Title and risk of loss (including responsibility for insurance coverage) shall thereupon pass to the Purchaser if it had not already passed;
- (ii.) Any amounts otherwise payable to the Seller upon Delivery or title transfer shall be payable upon presentation of the Seller's invoice(s) and certification of cause for storage;
- (iii.) All expenses incurred by the Seller, such as for preparation for and placement

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into storage, handling, inspection, preservation, insurance, storage, removal charges and any taxes shall be payable on a monthly basis by the Purchaser upon submission of the Seller's invoice(s);

- (iv.) The Services provided herein shall be subsequently changed to the rate prevailing at the time of actual use and the Purchaser shall pay the net increase;
- (v.) Seller shall be deemed to have accomplished Delivery of the Equipment per Article 7.3 above
- (vi.) If Purchaser has elected to use the transportation services described in Article 7.6 below, upon Purchaser's notice of its ability to accept Delivery of the Equipment and payment of all amounts due hereunder, the Seller shall resume transportation of the Equipment to the Delivery Point.

7.6 Seller's Transportation Service

As of the Effective Date of this Contract, Purchaser has elected this Option. Purchaser shall pay Seller for:

- (i.) All fees and expenses including, but not limited to, those covering preparation of consular documents, freight, storage and warehouse-to-warehouse insurance (collectively, "Transport Costs") plus
- (ii.) A shipping management fee in the amount of either:
 - a.) 10% of all Transport Costs actually incurred (if Seller receives Purchaser's election of this Option at least ninety (90) days' prior to the first Scheduled RTS Date) or
 - b.) 15% of all Transport Costs actually incurred (if Seller receives Purchaser's election of this Option less than ninety (90) days prior to the first Scheduled RTS Date).

These costs shall be invoiced separately. In performing such service, Seller will comply with any reasonable instructions of Purchaser or, in the absence thereof, shall act according to its best judgment. In acting on Purchaser's behalf hereunder, Seller shall retain risk of loss for the Equipment during transportation, subject to Article 24 of this Contract, but shall not be liable or otherwise held responsible under this Article or this Contract for any delay in performance of the transportation service or arrival of the Equipment. Seller's sole and exclusive schedule obligations are set forth in Article 8. Claims against Seller for shortages or errors in shipment must be made within 30 days after receipt of the Equipment by Purchaser and be accompanied by

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necessary documentation to substantiate the claim. Purchaser may not return Equipment without first receiving written permission from Seller and agreeing with Seller on the terms to cover such return.

Article 8 Schedule

The Seller shall provide the Notice of RTS for each Major Component by the date(s) set forth in the Scheduled RTS Date(s) schedule attached to this Contract as Attachment 7 (each, a "Scheduled RTS Date"). Partial shipments will be allowed.

If any Major Component is not ready to ship on or before the relevant Scheduled RTS Date(s) for reasons attributable to the Seller and not excused elsewhere in this Contract, the Seller shall pay as liquidated damages, and not as a penalty, a sum calculated in accordance with the table below, until actual Notice of RTS for such Major Component:

Delay Liquidated Damage Period	Amount of Delay Liquidated Damages
Delay periods below, expiring on the earlier of the date upon which (a) the delay liquidated damages cap is reached or (b) Seller delivers Notice of RTS	Rate per day per delayed Major Component (not including separately shipped components) during the Delay Liquidated Damage Period
Days 1-15	\$5,000
Days 16-30	\$10,000
Days 31+	\$20,000

No grace period will apply to Liquidated Damages for equipment that is not delivered in accordance with the Scheduled RTS Dates in Attachment 7 unless mutually agreed by Buyer and Seller. Liquidated damage computations shall disregard any accessory to the Major Component that is shipped separately. For purposes of computation of Liquidated Damages, Major Components shall be defined as follows:

- Combustion Turbine
- Combustion Turbine Enclosure
- Turbine Control Panel
- Generator
- Generator Enclosure
- Sprint Skid
- Auxiliary Skid
- Water Injection Skid
- Fin-Fan Cooler Skid

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Inlet Air Housing and associated components

Minor Components that make up the remainder of the material shipped direct, less small minor items, shall be delivered within 30 days after the Major Components ship date. Minor Component ship dates and deliveries are not subject to Delay Liquidated Damages, as part of this Agreement. Minor Component Equipment shall be defined as follows:

Skid Interconnection piping and tubing
CO₂ bottle fire protection skid
Equipment that is not considered integral to the operation of the Unit, such as miscellaneous components that are typically shipped via box (fasteners, filters, etc.)

The Seller's liability hereunder for delay liquidated damages shall not exceed seven and one half percent (7.5%) of the Unit Price for the Unit giving rise to such claim. The liquidated damages for delay in Notice of RTS shall be the Purchaser's exclusive remedy for and the Seller's sole obligation arising out of delayed Equipment.

Notwithstanding the foregoing, the Seller shall have no liability to the Purchaser for liquidated damages for delay with respect to any Unit unless, in the reasonable discretion of Purchaser, the delay in providing Notice of RTS for such Unit is the direct cause of an actual delay in the initial commercial operation of the Project.

If any drawing set to which drawing delay liquidated damages apply, excluding as-built drawings, is not submitted on or before the relevant submittal date indicated in Attachment 11 for reasons attributable to the Seller and not excused elsewhere in this Contract, the Seller shall pay as liquidated damages, and not as a penalty, \$500 per day of delay per drawing set, until actual submittal of such drawing set. The Seller's liability hereunder for drawing delay liquidated damages shall not exceed \$150,000. The liquidated damages for delay in delivery of drawings shall be the Purchaser's exclusive remedy for and the Seller's sole obligation arising out of delayed delivery of the drawings or data, excluding as-built drawings.

Article 9 Performance Guarantees

When tested in accordance with Attachment 8 and subject to the conditions specified in Attachment 8 and Attachment 9, the Seller guarantees that the Equipment will achieve the output, heat rate and NO_x emissions level set forth in the Stamped Guarantee Sheet attached hereto as Attachment 9. If the average performance of all Unit(s) fails to achieve the output or heat rate Performance Guarantees after the final performance test provided for in Article 11 below, the Seller shall pay to the Purchaser as liquidated damages, and not as a penalty, a sum calculated in accordance with the table below for each Unit that fails to achieve the output or heat rate Performance Guarantees:

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Criterion	Test Measurement Point	Liquidated Damages
Output	At Generator Terminals	\$1,000 for each kW below the applicable Performance Guarantee
Heat Rate	At Turbine Fuel Meter	\$5,000 for each btu/kWh (LHV) above the applicable Performance Guarantee
NO _x , CO, VOC Emissions	At Turbine Exhaust Flange	Liquidated damages not applicable. In lieu of any damages, Seller has a one-time duty to adjust and repair the Unit until the Performance Guarantee for NO _x , CO, and VOC is met. (Must Meet Remedy).

The Seller's aggregate liability hereunder for liquidated damages for failure to achieve the output Performance Guarantee shall not exceed seven and one half percent (7.5%) of the Unit Price of the Unit(s) giving rise to such claim. The Seller's aggregate liability hereunder for liquidated damages for failure to achieve the heat rate Performance Guarantee shall not exceed seven and one half percent (7.5%) of the Unit Price of the Unit(s) giving rise to such claim. The liquidated damages for failure to achieve the Performance Guarantees and the corrective action to be taken by the Seller for deficiencies in performance shall be the Purchaser's exclusive remedies for and the Seller's sole obligations arising out of such deficiencies.

In addition to the Performance Guarantees for output and heat rate, when tested in accordance with Attachment 8 and subject to the conditions set forth in Attachment 8 and Attachment 9, the Seller guarantees that each Unit will meet the Minimum Performance Criteria. If when first so tested, the Unit fails to meet the Minimum Performance Criteria, in lieu of liquidated damages, the Seller shall have a one-time duty to adjust and repair the Unit until the Minimum Performance Criteria is met (Must Meet Remedy).

Notwithstanding the foregoing, the Seller shall have no liability to the Purchaser for liquidated damages for failure to achieve the Performance Guarantees with respect to any Unit unless the Purchaser suffers economic harm as a result of the failure of such Unit to achieve the Performance Guarantees.

If the average performance of all Unit(s) exceeds the Performance Guarantees for either output or heat rate, then the Purchaser shall pay to the Seller as a bonus an amount calculated in accordance with the table below:

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Criterion	Bonus
Output	50% of the Liquidated Damage rate for output for each kW below the applicable Performance Guarantee for output
Heat Rate	50% of the Liquidated Damage rate for heat rate for each btu/kWh (LHV) above the applicable Performance Guarantee for heat rate

For avoidance of doubt, liquidated damages and/or bonus for output and heat rate shall be calculated on an individual Unit basis at each respective Site only, and not in the aggregate.

Article 10 Aggregate Limitation on Liquidated Damages

The Seller's overall aggregate liability hereunder for all forms of liquidated damages provided for in this Contract shall not exceed fifteen percent (15%) of the Unit Price of the Unit(s) giving rise to such claims. The Parties agree that the amount of liquidated damages set forth above are reasonable in light of the anticipated harm caused by the breach of duty related thereto and the difficulties of proof of loss and inconvenience or non-feasibility of obtaining any adequate remedy and the Parties are stopped from contesting the validity or enforceability of such liquidated damages.

Article 11 Performance Guarantee Testing**11.1 Performance Tests**

The performance tests shall be arranged and conducted by the Purchaser or its designee unless specifically stated below.

11.2 Performance Testing

The tests for output and heat rate shall be performed using the testing procedures and protocol set forth in Attachment 8 and subject to conditions set forth in Attachment 8 and Attachment 9, and shall be conducted immediately following the start-up period after the Seller has conducted final check-out of the Unit. If the output and heat rate tests are not conducted within the first 200 fired hours, degradation shall be applied in accordance with Article 11.6.

11.3 Emissions Testing

If required, Purchaser or its designee shall conduct the emissions tests at the engine exhaust. Purchaser shall provide Seller a copy of the initial compliance test report, as

submitted to the relevant air quality management agency.

11.4 Cure Period

If when first tested, the Unit(s) does (do) not meet the heat rate or output Performance Guarantees or the NO_x and CO emissions guarantees, the Seller shall be afforded sixty (60) calendar days, plus Delay Days if any, of access to the Unit(s) to undertake corrective action. During this period, Seller's access to the Equipment will not impact dispatch or revenue opportunities and all Seller activities shall be coordinated with the Purchaser. If the Seller requests access to the machine to correct the non-compliance and the Purchaser does not provide access to the machine due to revenue opportunities or any other reason as may be required by the Purchaser, the Seller shall be afforded, on a day per day basis, the number of days equal to the delay which shall be defined as a Delay Day. The Unit(s) will be re-tested when the Seller so requests, but in any event at the end of this cure period. The degradation correction provided in section 11.6 below will be in effect during the hours of Purchaser operation.

For the purpose of the cure period for VOC emissions, if when first tested, the Unit(s) does (do) not meet the VOC emissions guarantee, the Seller shall be afforded sixty (60) calendar days, plus Delay Days if any, of access to the Unit(s) to undertake corrective action. During this period, Seller's access to the Equipment will not impact dispatch or revenue opportunities and all Seller activities shall be coordinated with the Purchaser. If the Seller requests access to the machine to correct the non-compliance and the Purchaser does not provide access to the machine due to revenue opportunities or any other reason as may be required by the Purchaser, the Seller shall be afforded, on a day per day basis, the number of days equal to the delay which shall be defined as a Delay Day. The Unit(s) will be re-tested when the Seller so requests, but in any event at the end of this cure period.

11.5 Cost of Tests and Re-Tests

The Purchaser shall perform the initial performance tests at its cost. The Seller shall be notified of, and shall be represented at all such tests. If a re-test is required and to the extent the Seller was the cause of such re-test, the actual cost of the retest will be borne by the Seller. The actual cost of the re-test shall mean:

- (i.) Cost of special test personnel or special operating personnel provided by the Purchaser
- (ii.) Cost of special instrumentation and equipment (including rental cost) and including required calibration of the instrumentation

- (iii.) The Seller's personnel cost, but in no event whatsoever will the Seller be responsible for the cost of fuel or other consumables, normal operating personnel, or any other such cost typically borne by the Purchaser.

11.6 Degradation

In conducting the initial performance test or re-tests, the performance of the Unit shall not be adjusted for degradation until such Unit has operated in excess of two hundred (200) hours. The Seller's degradation curve shall be used to determine the adjustment for Unit output and Unit heat rate.

Article 12 Inspection and Factory Tests

12.1 Inspections and Tests at Seller's Facilities

Upon the Purchaser's request and with the Seller's prior written consent, the Purchaser's inspector shall be provided access to the Seller's facilities to obtain information on production progress and make inspections. Such access will be limited to areas concerned with the Equipment and shall not include restricted areas where work of a proprietary nature is being conducted. The Seller shall, in its sole discretion, determine the extent of the Purchaser's access to the Seller's facilities and the extent of factory testing to be conducted on the Equipment during normal business hours.

12.2 Inspections and Tests at Suppliers' Facilities

Subject to the conditions set forth in the foregoing paragraph, the Seller will make reasonable efforts to obtain for the Purchaser's access to its Suppliers' facilities for the purposes described in the paragraph above.

12.3 Inspection Not Acceptance

The Purchaser's inspection of the Equipment or its failure to inspect does not relieve the Seller of its obligation to fulfill the requirements of this Contract, nor is it to be construed as acceptance by the Purchaser.

Article 13 Warranty Period

The Seller shall warrant the Equipment and the Services on the terms set forth in Article 14 below for twelve (12) months following the date fuel is first combusted in the Unit at the Site, 4,000 operating hours or eighteen (18) months following the date of Seller's Notice of RTS, whichever period shall first expire (the "Warranty Period"), provided, however, that the warranty applicable to the Training Services shall be solely as set forth in Article 14 below.

Article 14 Warranty

14.1 Warranty

The Seller warrants to the Purchaser that:

- (i.) The Equipment to be delivered hereunder:
 - a.) shall be fit for the purpose of generating electric power when operated in accordance with the Seller's specific written operation instructions and, in the absence thereof, in accordance with generally accepted operation practices of the electric power producing industry and
 - b.) shall be free from defects in material, workmanship and title;
- (ii.) The Services shall be performed in a competent, diligent manner.

14.2 Remedy

If the Equipment delivered or Services performed hereunder do not meet the above warranties during the Warranty Period set forth in Article 13 of this Contract, the Purchaser shall promptly notify the Seller in writing and make the Equipment available promptly for correction. The Seller shall thereupon correct any defect, at its option by:

- (i.) Reperforming the defective Services
- (ii.) Repairing the defective part of the Equipment
- (iii.) Providing necessary replacement parts, including shipment of parts to Owner's site

Purchaser shall, at Seller's option, return any defective part that is replaced by Seller at Seller's expense to Seller's facility within thirty (30) days from the date of written instruction by Seller. The Seller shall provide technical advisory Services reasonably necessary for any such repair of the Equipment, but the Seller shall not be responsible for:

- (iv.) Removal or replacement of structures or other parts of the facility and
- (v.) Site labor for installation of parts or components.

If a defect in the Equipment or part thereof identified during the warranty period cannot be corrected by the Seller's reasonable efforts, upon mutual agreement by

both Parties, the Parties will negotiate an equitable adjustment in price with respect to such Equipment or part thereof. The condition of any tests shall be mutually agreed upon and the Seller shall be notified of and may be represented at, all tests that may be made

14.3 Warranty on Remedial Work

Any re-performed service or repaired or replacement part furnished under this warranty shall carry warranties on the same terms as set forth above in Article 13.

- (i.) The remainder of the original Warranty Period or
- (ii.) Six (6) months from the date of such re-performance, repair or replacement.

In any event the repair/replacement warranty period and the Seller's responsibilities set forth herein for such repaired or replacement part shall end no later than six (6) months after expiration of the original Warranty Period.

14.4 Exclusions

The Seller does not warrant the Equipment or any repaired or replacement parts against normal wear and tear, including that due to environment or operation, including excessive operation at peak capability, frequent starting, type of fuel, detrimental air inlet conditions or erosion, corrosion or material deposits from fluids. The warranties and remedies set forth herein are further conditioned upon:

- (i.) The proper storage, installation, operation, and maintenance of the Equipment and conformance with the operation instruction manuals (including revisions thereto) provided by the Seller and/or its Subcontractors or Suppliers, as applicable (including any required warranty preservation services in the event of long term storage) and
- (ii.) Repair or modification pursuant to the Seller's instructions or approval.

The Purchaser shall keep proper records of operation and maintenance during the Warranty Period. These records shall be kept in the form of logsheets and copies shall be submitted to the Seller upon its request.

14.5 Exclusive Remedies and Warranties

Except for:

- (i.) The performance liquidated damages for output and heat rate and

- (ii.) If applicable, any one-time Must Meet Remedy set forth in Article 9, the preceding paragraphs of this Article set forth the sole and exclusive remedies for all claims based on failure of or defect in the Equipment and Services provided under this Contract, whether the failure or defect arises before or during the Warranty Period and whether a claim, however instituted, is based on contract, indemnity, warranty, tort (including negligence), strict liability or otherwise.

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

Article 15 Taxes

15.1 Seller Taxes

The Contract Price includes applicable corporate and individual taxes that are measured by net income or profit and are imposed by any governmental authority of any country on the Seller, its employees, Subcontractors or Suppliers due to the execution or performance of this Contract.

15.2 Purchaser Taxes

The Contract Price excludes any sales, use, excise, value added, gross receipts, consumption, franchise, property, or similar taxes imposed by any federal, state, or local government. All such taxes shall be for the account of and shall be paid directly by the Purchaser. If Purchaser is exempt from any such taxes, Purchaser will provide Seller adequate documentation of exemption in accordance with the taxing authority requirements prior to title transfer. If Purchaser is exempt from any Purchaser Taxes, Purchaser will provide Seller adequate documentation of exemption in accordance with the taxing authority regulations at least sixty (60) days prior to the Scheduled RTS Date of the Equipment.

Article 16 EEO and Compliance with Laws

The Seller shall perform its obligations hereunder in compliance with the legal requirements set forth in the Equal Employment Opportunity Certificate attached hereto as Attachment 10.

Article 17 Pricing and Scope Assumptions

17.1 Original Equipment Definition

The original Equipment definition is established in Attachment 2.

17.2 Pricing Assumptions

The Contract Price is based on the engineering and manufacture of the Equipment in accordance with the Seller's design criteria, manufacturing processes and procedures and quality assurance programs, so as to comply with:

- (i.) Those portions of the codes and standards identified in Attachment 2 which the Seller has deemed applicable to the Equipment ("Codes and Standards")
- (ii.) The applicable United States Federal Laws in effect as of the Notice to Proceed ("Federal Laws")
- (iii.) The ambient site conditions (including temperature, humidity, elevation and any seismic or wind-loading requirements) identified by Purchaser prior to Notice to Proceed and set forth in Attachment 2 ("Ambient Site Conditions")
- (iv.) Those site-specific environmental requirements (including those governing emissions and noise) identified by Purchaser prior to Notice to Proceed and set forth in Attachment 2 ("Site Requirements")
- (v.) Those State and Local Laws identified by Purchaser in Attachment 2.

17.3 Changes to Codes and Standards or to Federal Laws

If any change to the Codes and Standards or any change in Federal Law requires a change to the Equipment, the Seller shall be entitled to a Change Order that includes equitable adjustments to the Contract Price, Scheduled RTS Date(s) and other provisions of the Contract that are impacted. In addition, during the manufacturing process at its discretion, Seller may make minor changes to the Equipment without entering into a Change Order, provided that such minor changes do not alter the Contract Price or Scheduled RTS Date(s).

17.4 Other Changes to Equipment Scope or Configuration, State or Local Laws, Ambient Site Conditions and Site Requirements

Except as set forth in this Article, changes to the Equipment and Services can be made only as provided in Article 18.

17.5 Order Definition Meeting

Unless otherwise agreed, the Seller will schedule an Order Definition Meeting within thirty (30) days of execution of this Contract. The Seller will advise the Purchaser of the final drawing delivery schedule during the Order Definition Meeting.

17.6 Project Manager

No later than the date of the Order Definition Meeting, the Purchaser will appoint an individual person as its Project Manager, will authorize that person to act on its behalf and will identify that person to the Seller. The Purchaser hereby represents to the Seller that the person so identified will be authorized to act on behalf of the Purchaser in matters connected with this Contract or the Project.

17.7 Automatic Release

If the Purchaser fails to provide any information required by this Article within the times herein specified, or if the Parties are not able to reach agreement as to the substance of a Change Order to which the Seller is entitled pursuant to this Article by the conclusion of the Order Definition Meeting, the Seller will deliver the Equipment as originally described in Attachment 2.

17.8 Permitting Support

Purchaser shall have sole responsibility for, and risk associated with, application for and maintenance of all permits, including but not limited to site-related, construction and environmental permits. The Seller shall provide reasonable assistance to the Purchaser in its endeavors relating to the permitting of the Site and cooperate by providing information for the purpose of obtaining the permits. In undertaking such assistance, the Seller shall not be obligated to incur out-of-pocket costs and expenses without reimbursement from the Purchaser.

17.9 Global Sourcing.

The Seller reserves the right in its discretion to obtain, source, subcontract, manufacture, fabricate and assemble the Equipment and any of its components and systems outside the United States or from non-domestic concerns, or both; it being understood that the quality standards and warranties of the Seller under the Contract shall be adhered to in all cases irrespective of source. Seller shall be responsible for those direct costs associated with its global sourcing and manufacturing activities that occur prior to title transfer to Purchaser.

17.10 Electronic Communication

The Parties agree to use the Seller's Customer Collaboration System as the primary medium for the storage and transmittal of drawings, specifications and project reports. The current Customer Collaboration System is Project Net. Selected individuals of the Purchaser and the Purchaser's Engineer shall have access to Project Net such that drawings and documents can be accessed and downloaded at any time by either party. Registration instructions and link for access to Project Net by the Purchaser and the Purchaser's Engineer shall be available within 10 working days following the conclusion of the Order Definition Meeting.

Article 18 Changes

18.1 Purchaser-Initiated Changes

The Purchaser shall have the right to request that the Seller consider changes to the Equipment or the Services, including modifications, alterations or additions. If the Purchaser wishes to request such a change, the Purchaser shall notify the Seller in writing. Within fifteen (15) days after receipt of such notice (unless otherwise extended by mutual agreement), the Seller shall advise the Purchaser of the feasibility of the requested change, and shall submit to the Purchaser a draft Change Order, unless the matter requires further investigation and research in which case Seller will provide an estimate of the time frame in which Seller will be able to submit a detailed response to Purchaser.

18.2 Seller-Initiated Changes

If the Seller wishes to propose a change, or if the Seller is entitled to a Change Order pursuant to the provisions of this Contract, the Seller shall submit to the Purchaser a draft Change Order.

18.3 Contents of Draft Change Order

The draft Change Order shall include:

- (i.) A technical description of the proposed change in such detail as the Purchaser may reasonably require,
- (ii.) A lump sum firm price adjustment (increase or decrease) in the Contract Price, if any, caused by the proposed change
- (iii.) All potential effect(s), if any, on the Scheduled RTS Date(s), or any other schedule or date for performance by the Seller hereunder

- (iv.) All potential effect(s), if any, on the Seller's ability to comply with any of its obligations hereunder, including the Seller's warranties and Performance Guarantees.

18.4 Process for Concluding Change Order

The Purchaser shall, within ten (10) days from the date of receipt of such information, either approve or disapprove the draft Change Order in writing or request additional time to consider the draft Change Order. If the Purchaser approves the Change Order, the Purchaser and the Seller shall then sign the Change Order that shall operate as an amendment to this Contract.

18.5 Agreement Required

All changes under this contract shall be subject to mutual agreement, and no Change Order will be effective until signed by both Parties.

18.6 Changes to Equipment Not Practicable

If the Seller determines that any change to the Equipment contemplated in the immediately preceding paragraphs is not practicable, the Seller will so notify the Purchaser and the Purchaser:

- (i.) May terminate this Contract in accordance with Article 6 of this Contract.
- (ii.) May direct completion without change.

Article 19 Excusable Delays

The Seller shall not have any liability or be considered to be in breach or default of its obligations under this Contract to the extent that performance of such obligations is delayed or prevented, directly or indirectly, due to:

- (i) Causes beyond its reasonable control; or
- (ii) Acts of God, acts (or failures to act) of governmental authorities, fires, severe weather conditions, earthquakes, strikes or other labor disturbances, floods, war (declared or undeclared), epidemics, civil unrest, riots, delays or accidents in transportation and car or transporter shortages; or
- (iii) Acts (or omissions) of the Purchaser including failure to promptly:
 - (a.) Provide the Seller with information and approvals necessary to permit the Seller to proceed with work immediately and without interruption,

or

- (b.) Comply with the terms of payment; or
- (iv) Shipment to storage in accordance with Article 7.5 above.

The Seller shall notify the Purchaser of any such delay and strive to mitigate the delay to the extent practicable. The Scheduled RTS Date(s) or other date of performance shall be extended for a period of time necessary to overcome the effect of such excusable delay. If the Seller is delayed by acts or omissions of the Purchaser, or by the prerequisite work of the Purchaser's other contractors or suppliers, the Seller shall also be entitled to an equitable price adjustment.

Article 20 Patents

20.1 Patent Indemnity

The Seller agrees to indemnify and hold harmless the Purchaser from any rightful claim of any third party that any Equipment manufactured by the Seller and furnished hereunder infringes any United States registered patent. If the Purchaser notifies the Seller promptly of the receipt of any such claim, does not take any position adverse to the Seller regarding such claim and gives the Seller information, assistance and exclusive authority to settle and defend the claim, the Seller shall, at its own expense and option, either:

- (i.) Settle or defend the claim or any suit or proceeding and pay all damages and costs awarded in it against the Purchaser, or
- (ii.) Procure for the Purchaser the right to continue using the Equipment, or
- (iii.) Modify the Equipment so that it becomes non-infringing, or
- (iv.) Replace the Equipment with non-infringing Equipment; or
- (v.) Remove the infringing product and refund the price.

If, in any suit arising from such a claim, the continued use of the Equipment for the purpose intended is forbidden by any court of competent jurisdiction, the Seller shall at its option take one or more of the actions under (ii.), (iii.), (iv.), or (v.) above. The foregoing states the entire liability of the Seller for patent infringement of any Equipment.

20.2 Exclusions

The above paragraph shall not apply to:

- (i.) Any Equipment which is manufactured to the Purchaser's design or
- (ii.) The use of any equipment furnished under this Contract in conjunction with any other apparatus or material not furnished by Seller, the combined use of which in and of itself gives rise to a claim of infringement.

As to any Equipment or use described in the preceding sentence, the Seller assumes no liability whosoever for patent infringement.

Article 21 General Indemnity

21.1 Seller's Indemnity

Subject to Article 24 the Seller agrees to indemnify and hold harmless the Purchaser from:

- (i.) Any physical damage to the property of third parties or
- (ii.) Injury to persons, including death, to the extent resulting directly from the negligence of the Seller or its officers, servants, agents, employees, and/or assigns while engaged in activities under this Contract.

21.2 Purchaser's Indemnity

The Purchaser shall likewise indemnify and hold harmless the Seller from:

- (i.) Any physical damage to property of third parties or
- (ii.) Injury to persons, including death, to the extent resulting directly from the negligence of the Purchaser, its officers, servants, agents, employees, and/or assigns while engaged in activities relating to this Contract.

21.3 Concurrent Liability

In the event such damage or injury is caused by the joint or concurrent negligence of the Seller and the Purchaser, the loss shall be borne by each Party in proportion to its negligence.

21.4 Limitation

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For purposes of this Article, "third parties" shall not include:

- (i) The Purchaser or the Owner;
- (ii) The subsidiaries, parents, Affiliates, agents, successors or assigns of the Purchaser or the Owner, including any operation or maintenance contractor; or
- (iii) Any party:
 - (a.) With any equity interest in the foregoing entities, or
 - (b.) With a security interest of any nature in any such entity's assets or property, or
 - (c.) Which claims or seeks to claim any of the rights, powers or privileges of the Purchaser or Owner under this Contract or claims or seeks to claim as a third party beneficiary of the Purchaser or Owner under this Contract.

Article 22 Insurance

22.1 Comprehensive General Liability

The Seller shall furnish and maintain Comprehensive General Liability insurance with limits of not less than \$1,000,000 per occurrence for bodily injury or death, and \$1,000,000 per occurrence property damage plus Contractual Liability coverage.

22.2 Automobile Liability

The Seller shall furnish and maintain automobile liability insurance with limits of not less than \$1,000,000 for each person, \$1,000,000 for each occurrence and \$1,000,000 for property damages.

22.3 Worker's Compensation

The Seller will comply with all federal and state workers compensation or similar laws that might impose any charge or liability on the Purchaser in connection with this Contract.

22.4 Certificates of Insurance

Upon written request by the Purchaser, the Seller shall furnish the Purchaser with certificates of insurance evidencing that insurance has been provided to meet the

above requirements. Such certificates shall state that no material change or cancellation can be effected without thirty (30) days prior written notice to the Purchaser.

22.5 Purchaser's Insurance

The Seller shall be included as an additional insured on the Purchaser's or Owner's All Risk/Builder's Risk Insurance Policy, which will include a waiver of rights of subrogation against the Seller. The deductible under this policy shall be for Purchaser's account.

Article 23 Termination for Cause; Suspension

23.1 Grounds for Termination by Purchaser

The Purchaser shall have the right to terminate this Contract for cause in the event that the Seller:

- (i) Becomes insolvent, makes an assignment for the benefit of its creditors, has a receiver or trustee appointed for the benefit of its creditors, or files for protection from creditors under any bankruptcy or insolvency laws; or
- (ii) Substantially breaches and fails to comply or perform its material obligations hereunder (but only with respect to a material obligation for which this Contract does not provide exclusive remedies), provided that:
 - (a.) The Purchaser shall first have provided the Seller with written notice of the nature of such breach and of the Purchaser's intention to terminate the Contract as a result of such breach, and
 - (b.) The Seller shall have failed within thirty (30) days after receipt of such notice (or such extended period as is considered reasonable by the Parties) either
 - i. To commence to cure such breach and diligently thereafter to pursue such cure, or
 - ii. To provide reasonable evidence that no such breach has occurred.

23.2 Remedy in the Event of Termination by Purchaser

If the Purchaser terminates this Contract as provided above, the Purchaser shall pay

the Seller that portion of the Contract Price allocable to the Equipment title transferred or Services performed prior to the termination notice. If the payments received by the Seller as of the date of such termination are in excess of such portion of the Contract Price, the Seller shall return the excess of such payments to the Purchaser. To the extent that Purchaser has paid for Equipment that has not yet been title transferred to Purchaser as of the date of the termination notice, Purchaser may elect to either:

- (i.) Continue to receive delivery of the Equipment upon full and complete payment for the Equipment or
- (ii.) Forego delivery and title transfer of the Equipment in exchange for a refund of the portion of the Contract Price allocable to the Equipment that has not been title transferred to Purchaser (in which case Seller shall retain title to such Equipment).

23.3 Suspension by Purchaser

It is expressly agreed that the Purchaser shall have no right to suspend manufacture of the Equipment except to the extent that Purchaser elects to exercise its rights hereunder to terminate this Contract for convenience or Seller default.

23.4 Grounds for Termination by Seller

The Seller shall have the right to terminate this Contract for cause in the event that the Purchaser:

- (i) Becomes insolvent, makes an assignment for the benefit of its creditors, has a receiver or trustee appointed for the benefit of its creditors, or files for protection from creditors under any bankruptcy or insolvency laws; or
- (ii) Fails to make any payment when due or to fulfill any payment conditions as set forth in the Contract, provided that:
 - (a.) The Seller shall first have provided the Purchaser with written notice of the nature of such failure and of the Seller's intention to terminate the Contract as a result of such failure, and
 - (b.) The Purchaser shall have failed within thirty days after receipt of such notice to correct such failure.

23.5 Remedy in the Event of Termination by Seller

If the Seller terminates this Contract as provided above, the Purchaser shall pay to the Seller the charges set forth in the Termination Schedule.

23.6 Suspension by Seller

The Seller shall have the right to suspend all work on the Equipment or Services immediately upon the failure of the Purchaser to make any payment when due. The Seller shall further have the right to suspend any shipment of the Equipment if all payments due prior to the applicable Scheduled RTS Date have not been made. Any cost incurred by the Seller in accordance with any such suspension (including storage costs) shall be payable by the Purchaser upon submission of the Seller's invoice(s). Performance of the Seller's obligations shall be extended for a period of time reasonably necessary to overcome the effects of such suspension, except that Seller's suspension shall not be deemed to extend the Warranty Period hereunder.

Article 24 Limitation of Liability

24.1 Limitation

The total liability of the Seller, on all claims of any kind, whether in contract, warranty, indemnity, tort (including negligence), strict liability, or otherwise, arising out of the performance or breach of the Contract or use of any Equipment shall not exceed the portion of the Contract Price allocable to the portion of the Equipment giving rise to the claim. All liability under this Contract shall terminate two (2) years after the Notice of RTS for the last Unit giving rise to the claim.

24.2 Exclusion of Consequential Damages

In no event, whether as a result of breach of contract, warranty, indemnity, tort (including negligence), strict liability, or otherwise, shall the Seller or its Subcontractors or Suppliers be liable for loss of profit or revenues, loss of use of the Equipment or any associated equipment, cost of capital, cost of substitute equipment, facilities, services or replacement power, downtime costs, fines or penalties charged to Purchaser for failure to meet permits, claims of the Purchaser's and/or Owner's customers for such damages, or for any special, consequential, incidental, indirect or exemplary damages and the Purchaser shall indemnify the Seller against such claims of the Purchaser's and/or Owner's customers.

24.3 Subsequent Purchasers

The Purchaser covenants and agrees that, in the event it seeks to transfer or assign

the Equipment and Services to any other third party, it shall, as a condition to such transfer or assignment, cause such third party to acknowledge and accept the restrictions and limitations afforded under this Contract for the benefit of the Seller and its Subcontractors and Suppliers, including the provisions of this Article. If the Purchaser fails to obtain acknowledgement from the subsequent purchasers, the Purchaser shall indemnify, defend and hold the Seller harmless from and against any and all claims in excess of these restrictions and limitations made by any subsequent purchasers of the Equipment or Services against the Seller for loss or damage arising out of the performance or non-performance of the Equipment or Services provided under this Contract.

24.4 Gratuitous Advice

If the Seller furnishes the Purchaser with advice or assistance concerning any products, systems or work which is not required pursuant to this Contract, the furnishing of such advice or assistance will not subject the Seller to any liability, whether in contract, warranty, indemnity, tort (including negligence), strict liability or otherwise.

24.5 "Seller" Defined

For the purposes of this Article, the term "Seller" shall mean the Seller, its Affiliates, Subcontractors and Suppliers of any tier, and their respective agents and employees, whether individually or collectively.

24.6 Limitations to Prevail

The provisions of this Article shall prevail over any conflicting or inconsistent provisions contained in any of the documents comprising this Contract, except to the extent that such provisions further restrict the Seller's liability.

Article 25 Proprietary Information

25.1 Confidentiality

At the time of furnishing confidential or proprietary information, the Parties shall expressly designate by label, stamp, or other written communication that the information or documentation furnished is confidential. The receiving Party agrees:

- (i.) To treat such information as confidential,
- (ii.) To restrict the use of such information to matters relating to performance of the Contract, and

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- (iii.) To restrict access to such information to its employees whose access is necessary in the implementation of the Contract.

The receiving Party may release confidential Information to its agents, consultants and Affiliates ("Representatives"), provided that these Representatives:

- (i.) Are informed of the confidential and proprietary nature of the confidential information and agree to be bound by the same standard of care as the receiving Party,
- (ii.) Have a need to know the confidential information,
- (iii.) Limit their use of the confidential information solely to purposes related to the Project and
- (iv.) Are not competitors of Seller.

Confidential information will not be reproduced without the other Party's prior written consent, and all copies of written information will be returned upon request except to the extent that such information is to be retained by the receiving Party pursuant to the Contract.

25.2 Exclusions

The foregoing restrictions do not apply to information which is:

- (i.) Contained in a printed publication which was released to the public by the disclosing Party prior to the date of the Contract;
- (ii.) Or becomes, publicly known otherwise than through a wrongful act of the receiving Party, its employees, or agents;
- (iii.) In possession of the receiving Party, its employees, or agents prior to receipt from the disclosing Party, provided that the person or persons providing the same have not had access to the information;
- (iv.) Furnished to others by the disclosing Party without restrictions similar to those herein on the right of the receiving party to use or disclose;
- (v.) Approved in writing by the disclosing Party for disclosure by the receiving Party, its agents or employees to a third party or
- (vi.) Provided to Purchaser's financing party under notice and requirement of confidentiality.

Upon receipt of a demand or request for the disclosure of confidential information, the receiving Party shall promptly notify the other Party and afford the Party an opportunity to seek a protective order or other appropriate form of security or remedy. In the event that the Parties fail to obtain a protective order or similar protection, the Party receiving the demand or request for disclosure of confidential information shall furnish only that portion of the confidential information that is legally required to be furnished and will exercise reasonable efforts to obtain reliable assurance that confidential treatment will be afforded the confidential information.

Article 26 Assignment and Change in Control

26.1 Eligible Assignees

An Eligible Assignee is an:

- (i.) Affiliate of the Purchaser, or
- (ii.) Engineering or construction contractor under contract with the Purchaser for the installation of the Equipment, provided that the Eligible Assignee offers Purchaser satisfactory evidence of its ability (both financial and otherwise) to fulfill the obligations of Purchaser hereunder.

26.2 Purchaser's Right to Assign to Eligible Assignees

The Purchaser may once assign its rights and delegate its obligations under this Contract to an Eligible Assignee, provided that:

- (i) The Purchaser shall notify the Seller of its intent to assign no less than ten business days prior to the execution of any such assignment;
- (ii) The Purchaser shall either:
 - (a.) Guarantee the obligations of the assignee by executing a guaranty in a form acceptable to Seller or
 - (b.) Retain its obligations under any payment, indemnity and bonus provisions of the Contract;
- (iii) The first assignee may not further assign or delegate any rights or obligations hereunder except to the original Purchaser; and
- (iv) The Purchaser shall in no event assign to its engineering or construction contractor the right to receive liquidated damages under this Contract.

26.3 Collateral Assignment

The Purchaser may also assign a collateral interest in the Contract to a lender who is not an Eligible Assignee as collateral security for a loan for the acquisition of the Equipment, provided however, that Purchaser and Lender agree that any future assignment to the Lender shall occur only as the result of the exercise by Lender of its remedies under the loan agreements relative to a bankruptcy or liquidation of Purchaser. Under no circumstances, however, shall a collateral assignment require Seller to deliver Equipment to Purchaser or an assignee if Seller has not been fully paid for such Equipment.

26.4 All Other Assignments and Transfers by Purchaser

All other assignments or transfers by Purchaser of any or all of its duties or rights under this Contract (by operation of law or otherwise) are subject to Seller's prior written consent. Further, Purchaser agrees that, until Purchaser receives title to the Equipment as set forth herein, Purchaser shall not, directly or indirectly sell, offer to sell or otherwise broker the Equipment.

26.5 Seller's Right to Assign

The Seller may assign its rights and delegate its obligations under this Contract to any Affiliate or subsidiary company. Seller may assign its rights and obligations to other parties with the prior written consent of Purchaser.

26.6 Conditions

Any assignment shall be subject to all limitations of liability contained in the Contract. The Purchaser may not assign this Contract except in accordance with this Article. Any purported assignment not in accordance with this Article shall be void and without effect.

26.7 Change in Control of Purchaser

If the Seller believes that a change in the ownership or control of the Purchaser prejudices the Seller's ability to enforce its rights under this Contract, the Purchaser shall furnish such additional security as the Seller shall reasonably require.

Article 27 Dispute Resolution

27.1 Referral to Senior Management

Any and all controversies, disputes or differences between the Parties to this

Contract, if not amicably settled by the Parties with thirty (30) days following written notice of dispute, shall be referred to senior management of the Parties for resolution. In the event the dispute has not been resolved within forty-five (45) days following referral to senior management, or such longer period as the Parties may mutually agree, then either Party may, upon ten (10) days notice to the other party, institute arbitration in accordance with the following paragraphs.

27.2 Arbitration

Any and all controversies, disputes or differences between the Parties to this Contract, if not resolved by referral to Senior Management, shall be resolved by arbitration pursuant to the Rules of the Center for Public Resources ("CPR") for Non-Administered Arbitration of Business Disputes as in effect at the time of the arbitration. The parties consent to a single, consolidated arbitration for all Disputes for which arbitration is permitted. The neutral organization for purposes of the CPR rules will be the CPR. The arbitral tribunal shall be composed of one arbitrator selected by agreement of the parties or, in the absence of such agreement within 60 days after either party first proposes an arbitrator, by the CPR. The arbitration shall be conducted in Houston. Both Parties shall have the right to present documentary evidence and witnesses and the right to cross-examine witnesses. On request of either Party, a transcript of the hearings shall be prepared and made available to the Parties. The arbitrators shall determine the Dispute in accordance with the Governing Law without giving effect to any conflict of law rules or other rules that might render such law inapplicable or unavailable, and shall apply this Agreement according to its terms. While recognizing that the Rules of the CPR govern any arbitration hereunder, the parties hereby specifically authorize the arbitrator to grant dispositive or partially dispositive motions where such relief would be warranted under the Federal Rules of Civil Procedure, and such relief should be granted where appropriate. The arbitrators shall not, however, have the power to:

- (i.) Impose obligations involving the limitations of liability or applicable remedies other than those set forth in and permitted by this Contract;
- (ii.) Award any damages excluded by Article 24.2 of this Contract or
- (iii.) Otherwise award damages inconsistent with the terms of the contract.

The Arbitrators shall be instructed to provide a detailed written opinion, in the English language, setting forth the basis for each of their findings. Reasonable expenses of the arbitration shall be borne in accordance with the decision of the arbitration.

The written decision of the arbitrators shall be final and binding upon both Parties. In the context of an attempt by either party to enforce an arbitral award or order, any

defenses relating to the parties' capacity or the validity of this Agreement or any related agreement under any law are hereby waived; and judgment on any award or order resulting from an arbitration conducted under this paragraph may be entered and enforced in any court, in any country, having jurisdiction thereof or having jurisdiction over any of the parties or any of their assets. Except as expressly permitted by this Agreement, no party will commence or voluntarily participate in any court action or proceeding concerning a Dispute, except:

- (i.) For enforcement of an arbitral award, or
- (ii.) To restrict or vacate an arbitral decision based on the grounds specified under applicable law and not waived above.

Article 28 Governing Law

This Contract shall be construed and interpreted in accordance with the laws of the State of New York, excluding its conflict of law rules (the "Governing Law of the Contract"), provided that any provision of such law invalidating any provision of this Contract or modifying the intent of the Parties as expressed in the terms of this Contract shall not apply.

Article 29 Software License

29.1 Grant of License

Purchaser is granted a limited license for any Software within the Scope of Supply. All Software is protected by the copyright laws of the United States and by applicable international treaties. No rights under copyrights are transferred to Purchaser, except as specifically provided herein. All Software provided by Seller remains Seller's property. If Purchaser receives Software that renders Software that Purchaser then has redundant, Purchaser must return the redundant Software to Seller or certify in writing that Purchaser has erased all copies of it. This license allows Purchaser to:

- (i.) Use the Software only on the Equipment on which it is installed at the time of delivery or, if Software is supplied separately, in connection with Equipment supplied by Seller. Purchaser must obtain a supplementary license from Seller (which Seller may or may not grant in its sole discretion) before using the Software in connection with any other equipment or for any other purpose.
- (ii.) Make one copy of the Software in machine-readable form solely for backup purposes. Purchaser must reproduce on each copy the copyright notice and any other proprietary legends that were on the original copy.
- (iii.) Transfer the Software and all rights under this license to another party as part

of the sale of the Equipment with which it is used, but only if the other Party agrees in writing to be bound by the terms of this Article and the other provisions of the Contract.

29.2 Distribution and Derivative Works

Purchaser may not distribute copies of the Software to others or electronically transfer the Software from one computer to another over a network. The Software contains trade secrets. In order to protect them Purchaser may not decompile, reverse engineer, disassemble, or otherwise reduce the Software to a human-perceivable form. PURCHASER MAY NOT MODIFY, ADAPT, TRANSLATE, RENT, LEASE, LOAN, RESELL FOR PROFIT, DISTRIBUTE, NETWORK, OR CREATE DERIVATIVE WORKS BASED UPON THE SOFTWARE OR ANY PART THEREOF.

29.3 Upgrades

Nothing herein shall be deemed to create an obligation on the part of Seller to provide any upgrade or revision to any Software other than pursuant to a specific written obligation to do so.

Article 30 Contract Documents

The following documents shall comprise the Contract, and shall together be referred to as the "Contract":

- (i.) This Contract, and
- (ii.) The enumerated Appendices hereto (all of which shall be incorporated herein by this reference)

Article 31 Effective Date

The Effective Date of this Contract shall be the last to occur of the:

- (i.) Date when it has been signed by both Parties and
- (ii.) Last date when any other conditions to effectiveness set forth in Attachment 3 have been met.

Notice to Proceed shall be deemed to have been given by Purchaser to Seller upon Seller's receipt of the first payment listed on Attachment 3.

Article 32 Entire Agreement

This Contract represents the entire agreement between the Parties and no modification, amendment, rescission, waiver or other change shall be binding on either Party unless assented to in writing by the Party's authorized representative. This Contract supersedes all previous written or verbal agreements regarding the Project, including any previous proposal, Agreement-in-Principle or Memorandum of Understanding. Any oral or written representation, warranty, course of dealing or trade usage not contained or referenced herein shall not be binding on either Party. Each Party agrees that it has not relied on, or been induced by, any representations of the other Party not contained in this Contract.

Article 33 Miscellaneous Provisions

33.1 Third-Party Beneficiaries

Except as provided in the Article 24, these provisions are for the benefit of the Parties hereto and not for any other third party.

33.2 Export Control

All sales hereunder of U.S.-origin goods and related technical data (including software) shall at all times be subject to the export control laws and regulations of the U.S. Government and any amendments thereof. The Purchaser agrees that it shall not make any disposition by way of transshipment, export, diversion or otherwise, except as said laws and regulations may expressly permit, of U.S.-origin goods and related technical data (including software) supplied by the Seller.

33.3 Survival

The Articles with the following titles shall survive termination of this Contract: Taxes, Warranty, Patents, General Indemnity, Limitation of Liability, Proprietary Information and Miscellaneous Provisions.

33.4 Non-Waiver

Waiver by either Party of any right under this Contract shall not be deemed a waiver by such Party of any other right hereunder.

33.5 Invalidity

The invalidity in whole or in part of any part of this Contract shall not affect the validity of the remainder of the Contract.

33.6 No Nuclear Use

The Equipment and Services sold hereunder are not intended for application (and shall not be used) in connection with any nuclear installation or activity and Purchaser warrants that it shall not use the Equipment and Services for such purposes, or permit others to use or permit others to use the Equipment or Services for any such purposes. If, in breach of the foregoing, any such use occurs, Seller shall have no liability for any nuclear or other damage, injury or contamination, and Purchaser shall indemnify Seller, its Affiliates and suppliers of every type and tier against any such liability, whether arising as a result of breach of contract, warranty, indemnity, tort (including negligence), strict liability or otherwise.

33.7 Changes and Improvements Beyond Scope

It is understood that Seller has the right to make changes in product design and add improvements to products or services at any time without incurring any obligations to install the same on or in connection with the Equipment and Services provided hereunder.

33.8 Counterparts

This Contract may be signed in any number of counterparts, each of which shall constitute one and the same instrument.

Contract For U.S. Based Sale of Equipment and Services

IN WITNESS WHEREOF the Parties have caused this document to be executed by their authorized representatives as of the Effective Date.

Seller

Purchaser

GE PACKAGED POWER, INC.

MMC ENERGY, INC.

By:

By:

(Signature)

(Signature)

(Printed Name)

(Printed Name)

(Title)

(Title)

(Date)

(Date)

Attachment 1 Defined Terms

The following defined terms will be used throughout this Contract:

- a) "Affiliate" shall mean any entity that directly or indirectly controls, is controlled by or is under common control with a Party. For the purposes of this definition, "control" means the possession, directly or indirectly, of the power to direct or cause the direction of the management and policies of the controlled entity, whether through the ownership of voting securities or partnership or other ownership interests or by contract or otherwise.
- b) "Ambient Site Conditions" shall have the meaning ascribed in Article 17.2.
- c) "Change in Laws" or shall mean a change to a Law, or a change in the interpretation or application of a Law by the cognizant executive or judicial authorities occurring after the date of Seller's original proposal to Purchaser.
- d) "Change Order" shall mean a written agreement to change the Equipment or Services which describes the change, identifies the writing as a Change Order, sets out adjustments, if any, in the Contract Price or Unit Price(s) and any other provision of this Contract which is affected, and is signed by both Parties.
- e) "Codes and Standards" shall have the meaning ascribed in Article 17.2.
- f) "Contract Documents" shall have the meaning ascribed in Article 30.
- g) "Contract Price" shall mean the total firm price as consideration for the Equipment and the Services, as set forth in Article 3 and as may be adjusted from time to time in accordance with this Contract.
- h) "Customer Collaboration System" shall have the meaning ascribed in Article 17.10.
- i) "Delivery" of the Equipment shall occur upon the event described in Article 8.
- j) "Delivery Point" shall have the meaning ascribed in Article 7.3.
- k) "Effective Date" shall mean the date described in Article 31.
- l) "Equipment" shall mean all of the equipment described in the "Equipment" portion of Attachment 2.
- m) "Eligible Assignee" shall have the meaning ascribed in Article 26.1.
- n) "Federal Laws" shall have the meaning ascribed in Article 17.2.

Contract For U.S. Based Sale of Equipment and Services

- o) "Governing Law of the Contract" shall have the meaning ascribed in Article 28.
- p) "Law" or "Laws" shall mean those laws, regulations, decrees or similar orders with mandatory effect issued by the legislative, judicial or executive branch of the relevant government, in effect as of the date of Seller's original proposal to Purchaser, to the extent such laws, regulations, decrees or similar orders are applicable to the scope of this Contract.
- q) "Local Laws" shall be those local Laws that are (a) identified by Purchaser in Attachment 2, (b) in effect as of the Notice to Proceed and (c) agreed to be incorporated into the manufacturing of the Unit(s) by Seller. If no Local Laws are set forth in Attachment 2 and agreed to by Seller, the manufacturing process shall not incorporate any consideration of Local Laws.
- r) "Major Components" shall have the meaning set forth in Article 8.
- s) "Minimum Performance Criteria" shall mean 95% of the Performance Guarantee for output and 105% of the Performance Guarantee for heat rate.
- t) "Minor Components" shall have the meaning set forth in Article 8.
- u) "Must Meet Remedy" is a one-time rather than continuing obligation on the part of Seller to repair or replace the Equipment so that the Equipment meets a designated performance criteria (e.g., the Minimum Performance Criteria). A Must Meet Remedy is offered in lieu of other remedies such as liquidated damages or warranty.
- v) "Notice of RTS" shall mean Seller's notice of readiness to ship the Equipment, or relevant portion thereof, from the relevant factory or warehouse.
- w) "Notice to Proceed" shall have the meaning ascribed in Article 31.
- x) "On-Site Services" are described in Attachment 12.
- y) "Order Definition Meeting" shall mean a project kick-off meeting between the Seller's project execution team and the Purchaser's project team.
- z) "Options" shall have the meaning ascribed in Article 4.
- aa) "Owner" shall mean that corporation, partnership, or individual which owns the facility in which the Equipment will be installed.
- bb) "Party" and "Parties" shall have the meanings ascribed in the foreword to this Contract.

Contract For U.S. Based Sale of Equipment and Services

- cc) "Payment Schedule" shall mean the schedule of payments attached to this Contract as Attachment 3.
- dd) "Performance Guarantees" shall mean the guaranteed values identified in the Stamped Guarantee Sheet attached hereto as Attachment 9.
- ee) "Project" shall mean Purchaser's power generation project.
- ff) "Purchaser" shall mean the entity so identified in the foreword to this Contract.
- gg) "Scheduled RTS Date(s)" shall mean the date(s) by which Seller will provide Notice of RTS for the relevant Unit(s), as set forth in Attachment 7 hereto.
- hh) "Scope of Supply" shall mean the Equipment plus the Services, as set forth in Attachment 2.
- ii) "Seller" shall mean the entity so identified in the foreword to this Contract.
- jj) "Services" shall mean all of the those services described in the "Services" portion of Attachment 2.
- kk) "Site" shall mean the location of the Project and place where the Equipment will be installed, as indicated in the Recitals to this Contract.
- ll) "Site Requirements" shall have the meaning ascribed in Article 17.
- mm) "Software" means a computer program or compilation of data that is fixed in any tangible medium of expression, or any storage medium from which the program may be perceived, reproduced or otherwise communicated, either directly or with the aid of a machine or device, and shall include without limitation any of Seller's proprietary operating Software, provided for the ordinary operation of the Equipment, any optional Software to enhance the operation of the Equipment, as well as any upgrades or revisions of this material the Seller provides in fulfillment of a specific written commitment or otherwise.
- nn) "State Laws" shall be those state Laws that are (a) identified by Purchaser in Attachment 2, (b) in effect as of the Notice to Proceed and (c) agreed to be incorporated into the manufacturing of the Unit(s) by Seller. If no State Laws are set forth in Attachment 2 and agreed to by Seller, the manufacturing process shall not incorporate any consideration of State Laws.
- oo) "Subcontractor(s)" shall mean any corporation, partnership, or individual having a contract with the Seller to supply labor or other services to be performed at the Site in connection with this Contract.

Contract For U.S. Based Sale of Equipment and Services

- pp) "Supplier(s)" shall mean any corporation, partnership, or individual having a contract with the Seller to supply material, equipment, labor, goods, or services to the Seller in connection with its obligations under this Contract, other than contracts labor or other services to be performed at the Site.
- qq) "Termination Schedule" shall mean the schedule of termination charges attached to this Contract as Attachment 5.
- rr) "Training Services" are described in Attachment 13.
- ss) "Unit" shall mean a single gas turbine and its associated generator, together with those accessories associated only with that gas turbine.
- tt) "Unit Price" shall have the meaning ascribed in Article 3.
- uu) "Warranty Period" shall have the meaning ascribed in Article 13.

Attachment 2 Scope of Supply

SCOPE OF SUPPLY

1.1 Basic Scope Description

1.1.1 *Gas Turbine*

General Electric gas turbine model LM6000 is a two-shaft/two-spool engine consisting of a five-stage low pressure compressor, a fourteen-stage high pressure compressor, a two-stage high pressure turbine, and a five-stage low pressure turbine. The engine is equipped with a stainless steel mesh screen in the inlet air stream for "last chance" protection against foreign object damage. The engine is shock mounted and shipped in position, with the exception of the coupling spacer, which is removed and shipped in a separate container.

1.1.2 *Generator*

Air cooled, 2-pole generator operating at 13.8 kV, 60 Hz. Generator is capable of handling Purchaser power requirement throughout a wide ambient temperature range. A cooling water loop and its associated fans and pumps are not required. The generator includes a brushless excitation system with permanent magnet generator. Neutral and line side cubicles are included.

1.1.3 *Unit Enclosure*

The basic equipment package is supplied with weatherproof acoustic enclosures with sound attenuation to an average of 85 dB(A) at 3ft 3 in (1 m) from the face of the equipment at 4 ft 11 in (1.5 m) above ground. The enclosures are completely assembled and mounted over the equipment prior to testing and shipment. The turbine and generator compartment is fully ventilated with belt driven fans. Explosion-proof lighting is provided in both compartments.

1.1.4 *Gas Turbine / Generator Baseplate*

The basic equipment package is supplied with the support structures for the gas turbine generator set consisting of a two-piece skid assembly, which is sectioned between the gas turbine and the generator. The full depth, bolted section is designed to provide the full structural properties of the wide flange I-beams. Full depth crossmembers are utilized to provide for a rigid design that is suitable for installation in earthquake areas (U.S. Seismic Zone 4) as well as providing a convenient structure for transportation. The baseplate support system is enhanced by the installation of a heavy-duty, welded superstructure, which utilize structural tubing for wall columns

and roof beams.

1.1.5 Air Inlet System

The basic equipment package is supplied with a modular, multi-stage filtration system consisting of inlet screens, a prefilter and a final barrier filter. All air for ventilation systems is filtered to the same level as turbine combustion air. An evaporative cooling system is included in the basic equipment package scope. Filtered air is silenced before entering the turbine plenum. This design results in a compact arrangement and eliminates the need for Purchaser supplied inlet ducting when the standard design is utilized. Internal lighting of the filter house is provided to facilitate inspection and service.

Package is also supplied with platforms and ladders to service the inlet filter. These items are packaged separately for shipment. Ladders, platforms and stairways to service other portions of the gas turbine generator enclosure are not included. Special or customized filter arrangements can be supplied, and they are quoted on an individual basis.

1.1.6 Turbine Exhaust

The basic equipment package is supplied with a circular, axial exhaust outlet with connection flange to facilitate in-line mounting of an HRSG or simple cycle exhaust stack.

1.1.7 Fuel System

The basic equipment package is supplied with a natural gas fuel system using an electronically controlled fuel-metering valve. All necessary shutoff valves, piping and instruments between the auxiliary skid connection and the turbine are included. For full-load operation, the gaseous fuel must be supplied to the baseplate at 675 psig \pm 20 (4,658 \pm 138 kPag). All necessary shutoff valves, piping and instruments between the baseplate connection and the turbine are included. Gas fuel must meet General Electric specification MID-TD-0000-1 (See Attachment 16).

1.1.8 Lube Oil Systems

The basic equipment package is supplied with two separate lube oil systems: one for the gas turbine (synthetic oil) and one for the generator (mineral oil). The oil reservoirs and piping are all stainless steel, and the lube oil system valves have stainless steel trim. Each lube oil system has duplex filters, duplex shell and tube coolers, and thermostatically-controlled electric heaters. The coolers, oil reservoir, and filters for each system are mounted on an auxiliary equipment module located next to the gas turbine baseplate. The auxiliary equipment module provides simplified piping

connections and reduces Purchaser's installation time and costs. Purchaser must supply cooling water to the shell and tube coolers. Turbine lube oil must meet MID-TD-0000-6 (See Attachment 16).

1.1.9 Electro-Hydraulic Start System

The basic equipment package is supplied with an electric motor driven hydraulic pump assembly, filters, cooler and controls, mounted on the auxiliary equipment module. A hydraulic motor is also mounted on the gas turbine accessory gearbox. Hydraulic hoses are furnished to connect the auxiliary equipment module and the main baseplate.

1.1.10 Fire Protection System

The basic equipment package is supplied with a factory installed fire protection system complete with optical flame detection, hydrocarbon sensing and thermal detectors, piping and nozzles in both generator and engine compartments. The fire protection system includes cylinders containing CO₂ mounted on a separate skid. A 24 V DC battery and charger to power the fire protection system is also included. All alarms and shutdowns are annunciated at the turbine control panel (TCP). An alarm sounds at the turbine if the gas detectors detect high gas levels, or if the system is preparing to release the CO₂. When the system is activated, the package shuts down, and the primary CO₂ cylinders are discharged into the turbine and generator compartments via multiple nozzles, and the ventilation dampers automatically close. After a time delay and if required, the reserve supply of CO₂ is discharged.

1.1.11 Digital Control System

The basic equipment package is supplied with a free-standing control panel suitable for mounting in an indoor, non-hazardous area. The control system features an integrated Woodward MicroNet Plus turbine control system, vibration monitor, digital meter, digital generator protective relay module and an HMI (human machine interface) display of key discrete and analog data. The operator selects HMI displays with convenient touch screen control. Alarm and shutdown events are displayed on the HMI automatically. An Ethernet TCP/IP EGD or RS485 Modbus Port is provided to transmit unit conditions (status, pressures, temperature, etc.) to the Purchaser's distributed control system. Power for the control panel is provided by a dedicated 24V DC battery system with dual 100% capacity chargers, which are shipped separately for installation by others.

1.1.12 Generator Protective Relays

The basic equipment package is supplied with a microprocessor-based generator

protective relay module, mounted in the TCP. The protective relay system includes functions necessary for protection of the generator.

1.1.13 Soak Wash System

The basic equipment package is supplied with a turbine cleaning system, which allows Purchasers to clean the compressor section of the turbine during full power operation. The same system reservoir and piping are utilized for off-line soak washing. Auxiliary skid connections are provided for Purchaser supplied purified water at a maximum of 50 psig (345 kPag) and air at 100 – 120 psig (689 – 827 kPag). Purchaser is required to provide purified water meeting MID-TD-0000-4, detergent meeting MID-TD-0000-5 (See Attachment 16), and air filtered to ISA S7.3 standards.

1.1.14 Component Testing and Package Full Load Test

Every new gas turbine is performance tested under load in a GE Test Cell, using procedures developed for flight turbine reliability. The generator is tested to ANSI C50.14 or IEC 34.3 standards at its factory of manufacture.

All gas turbine generator sets receive a rigorous 400-point static test including:

- Switch State (N.O. or N.C., actuation, wiring, and setpoint)
- Temperature element output, and wiring
- Transmitter range, output, and wiring
- Solenoid operation
- Control valve torque motor, excitation, and return signal
- Fire system continuity, and device actuation
- System flushing verification
- Tubing integrity

1.1.15 Drawings, Data and Manuals

The basic equipment package is supplied with a Purchaser drawing package that includes general arrangement drawings, flow and instrument diagrams, electrical one-line drawings and interconnection plan drawings. Additional electrical schematic diagrams and logic drawings are provided for record. See Attachment 11 for a detailed typical list and typical drawing delivery.

Maintenance manuals are provided and are printed in English. The manuals cover operating concepts for power generating equipment, guides to troubleshooting, basic information on components, and equipment within the turbine generator set.

Seller provides all engineering drawings on a secure server www.project-net.com. Each Purchaser can enter this database and view, print or annotate project drawings.

ProjectNet provides the Purchaser with immediate access to the latest drawing revisions. ProjectNet speeds job completion and saves weeks of time mailing drawings back and forth.

1.1.16 Training

The base scope of supply includes hands-on training for up to 10 operators and supervisors, where students are assumed to have at least a journeyman's knowledge of electrical generating plant operation and to be proficient in reading piping flow and instrument drawings, mechanical drawings, and have a working knowledge of electrical generators, and gas turbines. The course is designed around an eight-hour day, five consecutive day schedule with an hour lunch break and fifteen-minute breaks every one and one half hours. Experienced instructors, using specially developed training materials, provide a firm groundwork of basic theory, plus advanced concepts with classroom and hands-on training. Training includes Gas Turbine Familiarization plus System Design & Operations and Maintenance.

The trainer conducts the course in a lecture/seminar format where each major topic is supported by literature with detailed descriptions and associated engineering drawings. A student-training manual is given to each student and the client's turbine-generator system is used for hands-on training to supplement the classroom instruction. At the completion of several related topics the students are given a progressive examination to measure the effectiveness of the presentation and as a tool to identify if any student has not grasped the material. At the completion of the course a final examination is given which covers the entire course material and students are given a certificate of completion.

Training is conducted in Houston at the manufacturing facility. Local training at the Purchaser's facility is available upon request. The Purchaser would be responsible for providing all necessary training equipment (air conditioned classroom, VHS or PAL format video player, overhead projector, dryboards, chalkboards, etc.) for classes not held at the manufacturing location.

1.1.17 Improvements and Changes

It is understood that the Seller has the right to make changes in product design and add improvements to products or services at any time without incurring any obligations to install the same on or in connection with the Equipment or Services provided hereunder.

Contract For U.S. Based Sale of Equipment and Services

1.2 Optional Equipment and Services Checklist and Descriptions

(I) Included in base offer at prices indicated in Article 3

(S) Quoted Separately as unexercised Options listed in Attachment 4

1.2.1 Factory Options

I	Option A	SPRINT® Power Augmentation
I	Option B	NO _x Control - Water Injection System
I	Option C	Inlet Air Cooling – Evaporative Cooling
I	Option D	Lube Oil Cooler - Fin/Fan
I	Option E	Left-handed Piping Connections
I	Option F	Left-handed Lineside Cubicle
I	Option G	Lineside Cubicle Entry Configuration Options
I	Option H	DC Backup Lighting
S	Option I	Combustion Air Cooling – Chiller Coil
I	N/A	Auxiliary Skid Enclosure
S	N/A	SPRINT Skid Enclosure

1.2.2 Extended Scope Equipment Options

Not Applicable

1.2.3 Service Options

S	Option AAA	Technical Supervision
S	Option BBB	Transportation Services

1.2.4 Factory Options Descriptions

Option A SPRINT® Power Augmentation

SPRINT® boosts engine performance using a demineralized water spray intercooling design that significantly increases the mass flow by cooling the air during the compression process. The system is based on an atomized water spray injected through spray nozzles placed at two locations, one between the high pressure and low-pressure compressors, and the second at inlet bellmouth. Water is atomized using high-pressure air taken off of the eighth stage bleed. The water flow rate is metered, using the appropriate engine control schedules and at the inlet bellmouth. Bellmouth and inter-stage portions on SPRINT® alternate operation based on turbine inlet temperature. Purchaser supplies 30 gpm (114 lpm) of demineralized water to the connection on the unit. Water must meet GE specification MID-TD-0000-3 (See Attachment 16)

Option B NO_x Control - Water Injection System

A water injection system for control of NO_x emissions shall be provided. The demineralized water injection system consists of inlet strainer, pump, valves, piping and controls for use with a gaseous fuel, liquid fuel or dual fuel system. Water injection shall reduce NO_x emissions to 25 ppm (51 mg/N m³) (Ref. 15% O₂) on gaseous fuel. For gaseous fuel applications, Purchaser must provide a demineralized water supply of up to 55 gpm (208 lpm) and at 20-40 psig (138-276 kPag). Water must meet GE specification MID-TD-0000-3 (See Attachment 16). The minimum Purchaser supplied pressure and temperature is determined by the water injection rate required and the type of fuel nozzle utilized.

Option C Inlet Air Cooling – Evaporative Cooling

Evaporative cooling shall be utilized in the inlet air cooling system to lower the dry bulb temperature of the inlet ambient air, thus increasing power output of the LM6000 equipment.

This system is designed for recirculation of evaporative cooling water from a sump in the bottom of the inlet air filter. A recirculation pump, a conductivity probe, blowdown and make-up valves, piping and wiring shall be provided. Purchaser must supply filtered, potable water to a flanged connection on the filter house and must dispose of wastewater from the blowdown valve. Flow rates will vary based on blow down. Water must meet GE specification GEK 107158 (See Attachment 16).

Option D Lube Oil Cooler - Fin/Fan

This replaces the standard simplex shell and tube coolers for the lube oil systems. A simplex core fin-fan cooler complete with changeover valve mounted on a separate

base plate with dual fans is installed on a separate foundation.

Option E Left-handed Piping Connections

The Seller shall furnish one (1) right hand (standard) configuration and one (1) left hand configuration LM6000 Unit. The left hand Unit shall be built with the Purchaser's piping connections on the left side, as viewed from the exciter. The turbine removal door is placed on the side opposite the piping connections.

Option F Left-handed Lineside Cubicle

For the left hand Unit, the generator line-side cubicle shall be located on the left-hand side and the neutral cubicle shall be located on the right-hand side. However, the termination box for generator instrument and control wiring box, (MGTB) must remain on the right-hand side, and the turbine main terminal box (MTTB) must remain on the left.

Option G Lineside Cubicle Entry Configuration Options

Top Bus Duct Entry

The standard lineside cubicle is configured for bottom cable entry. With this option, the lineside cubicle is configured for top bus duct entry.

Top Cable Entry

The standard lineside cubicle is configured for bottom cable entry. With this option, the lineside cubicle is configured for top cable entry.

NOTE for Option E, Option F, Option G: Purchaser has elected to choose quantity one (1) Unit to be "Left-hand" configuration and one (1) Unit to be "Right-hand" configuration as described above. Configurations and delivery sequence to be finalized at the Order Definition Meeting. If the configuration or delivery sequence is changed after the Order Definition Meeting, Seller reserves the right to adjust Contract price and schedule accordingly.

Option H DC Backup Lighting

Seller shall furnish DC backup lighting in the turbine and generator enclosures as an option. The DC lights turn on anytime the normal AC power fails.

Option I Combustion Air Cooling – Chiller Coil

Lowering the combustion air inlet temperature can increase the power output of the LM6000 generator set. When specified, GE Energy can furnish high performance inlet

air chilling coils as an integral part of the air inlet system. Purchaser provides adequate quantities of chilled water and interconnecting piping to GE Energy furnished chilling coils at the filter house. The same coils can be used for anti-icing.

1.2.5 Extended Scope Equipment Options Descriptions

Not Applicable.

1.2.6 Extended Scope Equipment and Service Options Descriptions

Option AAA Technical Supervision

Seller provides technicians who supervise the startup and commissioning of the gas turbine generator set. Rates are based upon the published Technical Assistance for Start-Up and Installation Rate Sheet in effect at time of service. Travel and living expenses are not included.

Installation services will include supervising the installation of the combustion turbine package by the Owner's construction contractor. Commissioning services will include flushing supervision, checkout, and commissioning supervision of combustion turbine mechanical systems, checkout and commissioning supervision of combustion turbine electrical systems, and checkout and commissioning of the combustion turbine package control system. Seller will provide all general hand tools required for the commissioning of the unit. Flushing and calibration kits can also be provided at Seller standard published rates.

The personnel required at site for the installation and commissioning of the combustion turbine packages is as noted below. The scope of work included in this proposal assumes that the installation and commissioning schedule of the combustion turbine package is not impacted by the installation and commissioning schedules of additional balance of plant equipment that is not provided by Seller (such as a demineralized water plant, steam turbine, gas compressors, etc.). Man-hour estimates are provided below.

Mechanical and Controls TA – Total of 2,520 man-hours between these individuals for a Two (2)-Unit Site.

Also included in the services quoted are the various combustion turbine package vendors will be required to commission specific combustion turbine package components. These are as noted below:

Generator Specialist –This individual will be responsible for testing of the generator and commissioning of the automatic voltage regulator system. Total of 120 man-hours for a Two (2)-Unit Site.

The normal workweek will be limited to 60 hours (ten (10) hours per day for six (6) days per week). Standby time will be billed incremental to the hours noted above. If the Installation and Commissioning schedule dictates longer working hour durations then additional resources can be provided on an incremental daily rate basis. The indicative estimated pricing shown in Article 3 for these services includes all travel and living expenses and is based on a single mobilization for each individual. Multiple mobilizations as a result of the Owner's construction schedule will be billed accordingly.

For reference only, Seller has provided a indicative estimated pricing for the field service requirements as spelled out in this section of the proposal. In order to provide these numbers, Seller has assumed typical construction schedules to arrive at the man-hour estimates illustrated above. Should the Owner's schedule or the Owner's construction contractor's experience result in an increase in the construction duration assumed, the Service Rates in effect at time of service would be applied as appropriate. Current rates are provided in Attachment 17 for reference.

Vendor Installation and Commissioning Services and Training for the BOP equipment have been excluded, however, can be provided on a time and materials basis.

Option BBB Transportation Services

Seller arranges for shipment on behalf of the Buyer. The Buyer pays the Seller for all fees and expenses including, but not limited to, those covering preparation of consular documents, freight, loading fees at storage, storage, transit insurance and warehouse-to-warehouse insurance. See Section Article 7 for associated Delivery terms.

1.3 Limits of Seller Scope & Exclusions

1.3.1 Limits of Seller Scope

Listed below are the limits/exclusions to the Seller standard Scope of Supply. All piping, wiring, cables, ducts, etc. connecting to these points is furnished by Purchaser (others) unless modified by specification agreement.

Equipment System	Limits of Seller Scope
All piping, including Fuel Gas, Fuel Oil, Steam, Cooling Water, Heating Water, Demineralized Water, Lube Oil, Compressed Air, Instrument Air, Hydraulic Start Oil	Flanged or threaded connection on Seller baseplate.
Inlet Air-to-Filter	Atmosphere (non-standard duct by others)
Turbine Package Ventilation/Cooling Air	Atmosphere (non-standard duct by others)
Turbine Exhaust	Exhaust flange on main baseplate
Instruments on Seller's Baseplate	Terminal box on baseplate
Instrument wiring in Turbine Control Panel	Wiring Terminal block in Turbine Control Panel
High Voltage Connections	Bus bar in Seller Lineside cubicle
Generator Ground Connections	Seller Neutral cubicle
Electric Motors	Terminal box on individual motor
Ladders and Platforms for Air Filter	Ladders and Platforms for Inlet Air Filter maintenance only
24 V DC Batteries and Chargers for Control System and Fire and Gas Systems	Battery terminals to baseplate (if supplied loose)

1.3.2 Exclusions

- Civil engineering design of any kind
- Building and civil works
- Site facilities
- Drains and/or vent piping from the gas turbine package to a remote point
- Fuel storage, treatment and forwarding system
- Site grounding
- Lightning protection
- Power system studies
- Sensing and metering voltage transformers
- Machine power transformers, and associated protection
- Grid failure detection equipment
- Off-loading, transportation and storage
- Off-skid cabling, and design of off-skid cable routing
- Balance of plant and energy optimization controls
- Anchor bolts, embedments, and grouting (quoted separately)
- Distributed plant control
- Purchaser's remote control
- Field supervision (quoted separately)
- High voltage transformer(s), cables, and associated equipment
- Interconnecting piping, conduit, and wiring between equipment modules
- Plant utilities, including compressed air supply and off-skid piping
- Battery containment
- Lube oil measurement other than that defined in the scope of supply
- Additional lube oil breather ducting other than that defined in the scope of supply
- Fuel transfer pump
- Off-skid fuel block and vent valves
- Fuel supply pipework beyond the scope of supply
- Generator controls other than that defined in the scope of supply
- Load sharing control
- Balance of plant controls
- Field Performance Testing
- Site Labor
- Ladders, Stairs, and Platforms for equipment beyond the gas turbine

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1.3.3 Codes and Standards

Seller considers the applicable sections of the following US and ISO Codes and Standards to be the most relevant Standards for gas turbine equipment. Our designs and procedures are generally compliant with applicable sections of the following:

AGMA 421	Standard Practice for High Speed Helical and Herringbone Gear Units (Used for the accessory gear except for service factor.)
ANSI/AFBMA	
Std 9	Loading Ratings and Fatigue Life for Ball Bearings.
Std 11	Load Ratings and Fatigue Life for Roller Bearings.
ANSI A58.1	Minimum Design Loads for Buildings and Other Structures (Used for Snow Loads)
ANSI B1.1	Unified Inch Screw Threads (Seller complies at the Purchaser's connection)
ANSI B1.20.1	Pipe Threads
ANSI B16.5	Steel Pipe Flanges and Flanged Fittings
ANSI B16.9	Factory - Made Wrought Steel Butt Welding Fittings
ANSI B16.21	Non-metallic Flat Gaskets for Pipe Flanges. (Spiral-wound gaskets per API 601 may be used, particularly in turbine compartment piping.)
ANSI B31.1	Pressure Piping and gas turbine piping systems comply.
ANSI B133.2	Basic Gas Turbine. Seller complies, with the exception of paragraph: 8.5 Loose items such as jackscrews and eyebolts are not furnished. Provisions for use of such items are not included in the design.
ANSI B133.3	Gas Turbine Auxiliary Equipment. Seller complies fully with design portions only. Seller uses its own lube oil flushing procedure. Atomizing air receiver is not applicable.
ANSI B133.4	Gas Turbine Controls and Protection Systems
ANSI B133.5	Gas Turbine Electrical Equipment
ANSI B133.8	Gas Turbine Installation Sound Emissions

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ANSI C37.90	Relays Associated with Electric Power Apparatus
ANSI C37.90.1	Guide for Surge Withstand Capability (SWS) Tests
ANSI C50.10	General Requirements for Synchronous Machines
ANSI C50.13	Requirements for Cylindrical Rotor Synchronous Generators
ANSI C50.14	Requirements for Combustion Gas Turbine Driven Cylindrical Rotor Synchronous Generators (Seller does not provide a peak reserve rating. Not all of the prototype tests indicated in Table 2 have necessarily been conducted.)
ANSI C57.94	American Standard, Guide for Installation and Maintenance of Dry Type Transformers
ANSI C83.16	Relays
ANSI S1.2	Method for the Physical Measurement of Sound
ANSI S1.4	Specification for Sound Level Meters
ANSI S1.13	Method for the Measurement of Sound Pressure Levels
ANSI/ASHRAE 52.1-1992	Gravimetric and Dust Spot Procedures for Testing Air-cleaning Devices Used in General Ventilation for Removing Particulate Matter
ANSI/IEEE C37.2	Electrical Power System Device Function Numbers (Seller complies with respect to device designations except that in a few cases device numbers had to be modified or added to fit Seller's needs.)
ANSI/IEEE 100	IEEE Standard Dictionary of Electrical and Electronics Terms
ANSI/NEMA MG1	Motors and Generators
ANSI/NEMA MG2	Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motor and Generators
ANSI/NFPA 12	Carbon Dioxide Extinguishing Systems
ANSI/NFPA 70	National Electrical Code (Electrical components are designed to meet the intent of this Code for Class 1, Group D, Div. 2, Hazardous area classification where appropriate.).
API 614	Special-Purpose Gear Units for Petroleum, Chemical, and Gas

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	Industry Services
API 614	Lubrication, Shaft-Sealing, and Control - Oil Systems for Special - Purpose Applications
API 616	Gas Turbine for Refinery Services
API 650	Storage Tanks
API 670	Vibration Monitoring Systems
API 671	Special-Purpose Gear Units for Petroleum, Chemical, and Gas Industry Services
API 678	Accelerometer - Based Vibration Monitoring System
API RP11PGT	Packaged Combustion Gas Turbines
ASME PTC22	Gas Turbine Power Plants - Performance Test Codes
ASME Section VIII	ASME Boiler and Pressure Vessel Code
ASME Section IX	ASME Boiler and Pressure Vessel Code
AWS D1.1	American Welding Specification
EIA RS-232	Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Interchange
IEC 34.1	Rotating Electrical Machines - Rating and Performance
IEC 34.3	Rotating Electrical Machines - Turbine Type Synchronous Machines
IEEE Std. 421	IEEE Standard Criteria and Definitions for Excitation Systems for Synchronous Machines
JIC	Hydraulic Standards for Industrial Equipment
UBC	International Building Code 2000 (Used for Wind Loads and Seismic Design)

Exceptions to Codes and Standards:

Seller takes specific exception to Codes and Standards not listed above and to any requirements to conform to unidentified state, county, municipal or other local codes and standards. Seller will prepare comments and exceptions to the technical provisions of any Purchaser-identified additional codes and standards within thirty

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(30) days of receipt of the code documents, when accompanied by Purchaser's description of the applicable sections.

1.4 Design Criteria

The following table outlines the criteria conditions at the proposed jobsite for the design of the equipment:

Location	Chula Vista, California
Elevation	57 ft ASL
Ambient Temperature Range	30°F – 110°F
Design Point Ambient Temperature	82°F
Relative Humidity	40% RH
Fuel Source	Gas Fuel
Seismic Design Criteria	IBC 2000 Seismic Group II; Seismic Design Category F
Maximum Wind Speed (Wind Load), MPH	100
Near Field Noise at 3 ft horizontal and 5 ft vertical, dBA <small>NOTE 1, 2</small>	85 dB(A) on average each item
Far Field Noise, dBA <small>NOTE 1</small>	65 dBA at 400 ft

NOTE 1: Far field noise is based on single-unit only operation. Multiple units operating at the same time will have an impact on both near and far field noise levels.

NOTE 2: Average sound pressure level at locations around the package, as tested in a free-field condition over a hard reflecting ground plane.

Attachment 3 Payment Schedule

(See attached)

On the Readiness to Ship Milestone, payment must be received at least 5 days before shipment, but no later than 30 days from Readiness to Ship.

The terms and conditions for payment are set forth in Article 5 of the Contract.

702846 MMC Energy
Chula Vista Project

PAYMENT SCHEDULE								
		Unit 1			Unit 2			
Ref	Due Date		% Price	Amount (USD)		% Price	Amount (USD)	Cumul Amt (USD)
1	30-Jan-08	Within 5 Days of Contract Signing	20%	\$ 3,100,254.00	Within 5 Days of Contract Signing	20%	\$ 3,100,254.00	\$ 6,200,508.00
2	15-Feb-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 7,869,875.54
3	15-Mar-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 9,539,243.08
4	15-Apr-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 11,208,610.62
5	15-May-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 12,877,978.15
6	15-Jun-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 14,547,345.69
7	15-Jul-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 16,216,713.23
8	15-Aug-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 17,886,080.77
9	15-Sep-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 19,555,448.31
10	15-Oct-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 21,224,815.85
11	15-Nov-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 22,894,183.38
12	15-Dec-08		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 24,563,550.92
13	15-Jan-09		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 26,232,918.46
14	15-Feb-09		5.38%	\$ 834,683.77		5.38%	\$ 834,683.77	\$ 27,902,286.00
15	6-Mar-09 ^{NOTE 1}	At RTS Unit 1	10%	\$ 1,550,127.00				\$ 29,452,413.00
16	27-Mar-09 ^{NOTE 1}				At RTS Unit 2	10%	\$ 1,550,127.00	\$ 31,002,540.00
		100% \$ 15,501,270.00			100% \$ 15,501,270.00			\$ 31,002,540.00

NOTE 1 Final RTS payments are due on the respective notification of readiness to ship dates

NOTE 2 Contract Price based on scope listed in Article 3 of the Contract as of Contract Effective Date.

Contract For U.S. Based Sale of Equipment and Services

Attachment 4 Schedule of Options

This Schedule of Options is designed to describe only those options that have been specifically and separately quoted to Purchaser, but have not yet been elected by Purchaser as of the execution of this Contract. If elected, the price for these options shall be added to the Contract Price set forth in Article 3 of the Contract.

Proposal Reference	Description	Addition to Contract Price Each Unit (U.S. Dollars)	Deadline for Exercise of Option
Option I	Combustion Air Cooling – Chiller Coil	\$368,890.	At Order Definition Meeting
N/A	SPRINT Skid Enclosure	\$30,000.	At Order Definition Meeting

Attachment 5 Termination Schedule

(See Attached)

702846 MMC Energy
Chula Vista Project

TERMINATION SCHEDULE						
		Unit 1		Unit 2		
Ref	Date	% Price	Amount (USD)	% Price	Amount (USD)	Cumul Amt (USD)
1	30-Jan-08	20%	\$ 3,100,254.00	20%	\$ 3,100,254.00	\$ 6,200,508.00
2	15-Feb-08	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 7,869,875.54
3	15-Mar-08	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 9,539,243.08
4	15-Apr-08	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 11,208,610.62
5	15-May-08	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 12,877,978.15
6	15-Jun-08	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 14,547,345.69
7	15-Jul-08	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 16,216,713.23
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11	15-Nov-08	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 22,894,183.38
12	15-Dec-08	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 24,563,550.92
13	15-Jan-09	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 26,232,918.46
14	15-Feb-09	5.38%	\$ 834,683.77	5.38%	\$ 834,683.77	\$ 27,902,286.00
15	6-Mar-09 ^{NOTE 1}	10%	\$ 1,550,127.00			\$ 29,452,413.00
16	27-Mar-09 ^{NOTE 1}			10%	\$ 1,550,127.00	\$ 31,002,540.00
		100%	\$ 15,501,270.00	100%	\$ 15,501,270.00	\$ 31,002,540.00

NOTE 1 Final RTS payments are due on the respective notification of readiness to ship dates

NOTE 2 Contract Price based on scope listed in Article 3 of the Contract as of Contract Effective Date.

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Attachment 6 Lien Waiver Form

UNCONDITIONAL WAIVER AND RELEASE UPON FINAL PAYMENT

California Civil Code Section 3262(d)(4)

The undersigned has been paid in full for all labor, services, equipment or material furnished to MMC Energy located off 26 Broadway, Suite 907, NY, NY, 10004 and does hereby waive and release any right to a mechanic's lien, stop notice, or any right against a labor and material bond on the job.

DATE

COMPANY NAME

BY

TITLE

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. THIS DOCUMENT IS ENFORCEABLE AGAINST YOU IF YOU SIGN IT, EVEN IF YOU HAVE NOT BEEN PAID. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

NOTE: This form complies with the requirements of California Civil Code Section 3262(d)(4).

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Attachment 7 Scheduled RTS Date(s)

Reference	Equipment Description	Scheduled RTS Date
Unit 1	LM6000PC Generating Set	6 March 2009
Unit 2	LM6000PC Generating Set	27 March 2009

Attachment 8 Test Procedures and Protocol

(See Attached)



TYPICAL SPECIFICATION FOR GAS TURBINE GENERATOR PERFORMANCE TEST MEASUREMENT (LM6000PC SPRINT - GAS FUEL – NOx Water Injection)

I. INTRODUCTION

An Owner's acceptance of a gas turbine power generation facility is usually preceded by proof of compliance with specific performance requirements for the gas turbine generator set(s). GE Energy provided a performance guarantee of Gross Power Output at Generator Terminals and Gross Heat Rate at Guaranteed Power Output that is passed through to the Owner.

If the Customer plans to use the results of the field test as a basis to determine the fulfillment of contractual requirements, a manufacturer's representative will provide the following field services:

- Supervise collection of data by owners, operators, engineers or other qualified parties for the gas turbine generator set.
- Validate calibration of pertinent instruments.
- Reduce the recorded data in accordance with the manufacturing site performance data correction procedure.
- Issue a field performance test report.

II. SCOPE AND PURPOSE

The primary purpose of this test shall be to demonstrate the guaranteed generator electrical output and heat rate for GE Aeroderivative Gas Turbine Generator (GTG). The guarantee power level will be achieved without exceeding specified engine control limits: High-pressure rotor speed, high-pressure compressor discharge pressure and temperature, and low-pressure turbine inlet temperature

Other tests, such as emissions and noise, are typically identified by the permitting regulatory agency and, therefore, not covered in this document.

The scopes of responsibilities, for all parties involved in the performance test, are as follows:

- One GE Energy Test Engineer who is responsible for supervising all aspects of the test.
- GE Energy and Customer representatives will be responsible for recording the data that is being collected.
- The GE Energy test engineer performs the computations of the test results.
- Personnel are to be provided by Customer to assist in logging manual data or collecting fuel samples.
- One operator representing the Customer will be responsible for operating the unit. The operator maybe assisted by GE Energy Controls Technician.
- A compressor cleaning crew will be utilized for an offline compressor water wash. This procedure is to be conducted no more than three days prior to the performance test.
- In addition to the above, CUSTOMER, independent engineers, and GE Energy may have observers on the site during the test.



III. TEST PROCEDURE

GE Energy testing procedures are in general compliance with ASME PTC 22-1997. Comments to ASME PTC 22-1997 are available for review.

A. Test Setup

The customer will make every effort to insure the test takes place before 200 fired hours have elapsed on the gas turbine engine. Furthermore, the GTG must operate at steady base load and in new and clean condition for 24 cumulative hours prior to commencing the test. GE Energy representatives shall determine, in their sole discretion, whether the GTG meets these criteria.

If more than 200 fired hours have elapsed before the test, then the manufacturer's representative shall have the right to inspect the turbine, compressor and ductwork areas to determine the GTG condition. If, at the manufacturer's sole discretion, the subject unit is not in new and clean condition, then appropriate action shall be taken to put the unit in new and clean condition and a degradation factor will be applied.

B. Preparation

An off-line water wash is to be conducted, no more than 3-days prior to, and no less than 1-day before, the scheduled performance test of initial unit.

Instruments and apparatus used for determinations shall be calibrated in accordance to the National Institute of Standards and Technology. Calibration certificates for customer furnished instruments shall be available for GE Energy inspection prior to field-testing. Finally, GE Energy furnished instruments to the unit control panel shall be checked and properly adjusted prior to testing. **NOTE:** Additional details of the instrument requirements are provided in *Table 1 –Accuracy of Required Instruments* at the end of this document.

C. Conduct of the Test

1. **Definition of Test Boundary**

The test boundary establishes the equipment to be included in the test. All input and output energy streams must be determined with reference to the point at which they cross the test boundary. The test boundary for this test includes the Gas Turbine Generator Package and Control Limits

2. **Determination of GTG Steady State Condition**

Test data will be recorded only when GTG is online and operating at a steady state base load condition. The GTGs will be considered at steady state when variations from the average value of the following parameters do not exceed the listed limits



during the test period.

- Compressor Inlet Temperature, T2 $\pm 4.0^{\circ}\text{F}$
- Barometric Pressure $\pm 0.5\%$
- Power Output $\pm 2.0\%$

3. **Test Duration and Number of Data Sets**

One test point will be conducted over a (50) *fifty-minute period*. A test point is defined as six complete sets of instrument readings recorded at (10) *ten-minute intervals*.

4. **Data Collection Methodology**

Data collection methodology will be as follows:

- One GE Energy Test Engineer who is responsible for supervising all aspects of the test.
- GE Energy and Customer representatives will be responsible for recording the data that is being collected.
- Personnel are to be provided by Customer to assist in logging manual data or collecting fuel samples.
- One operator, representing Customer, will be responsible for operating the unit. The operator may be assisted by GE Energy Controls Technician
- Manually collected data: Designated personnel provided by both GE Energy and Customer will collect all test data manually.
- Automated data collection: There is no automated data collection associated with this test.
- Data sampling frequency: A complete data set will be collected once every ten (10) minutes.

The Customer and GE Energy representative will sign all data sheets at the completion of the test. The Customer will be provided with copies of all data sheets. GE Energy will retain the originals for use in preparing the official test report.

5. **Gas Fuel Analysis and Sampling**

The owner will arrange for sampling and analysis of fuel. Analysis of fuel shall give composition of the natural gas in mole %, HHV, LHV, and specific gravity. See Appendix IV for analysis methods.

Three (3) fuel samples will be collected during the performance test. First sample at the beginning of the test, second sample approximately 25 minutes into the test, and the third sample at the conclusion of the test. Sample bottles are to be marked with the time, data, unit/sample number, and fuel temperature at time of test.

Two (2) of the three (3) samples are to be sealed, labeled and sent off for analysis by the Customer. The third sample is to be held at the site until analyzed samples are reviewed and deemed acceptable by GE Energy and Customer.



IV. INSTRUMENTS REQUIRED

Table 1 gives a general list of the test equipment, recommended accuracies, and parties responsible for supplying such equipment to conduct the performance test. GE maybe able to provide the following equipment to supplement any equipment not supplied by the customer: power meter, barometer, psychrometer, inlet plenum manometer, and exhaust duct manometer.

A. Generator Power Output

Generator output shall be measured by a precision 3-phase wattmeter.

GE Energy furnished current transformers are certified to $\pm 0.3\%$ accuracy. A total kW monitoring system uncertainty of $\pm 0.5\%$ is attainable with this calibrated system.

B. Fuel Heat Input - Gaseous Fuels

The fuel gas flow meter to be used during the performance test is to have an accuracy of $\pm 0.8\%$. Pressure at the fuel gas meter is to be measured with a pressure transducer having $\pm 0.25\%$ accuracy. Temperature at the fuel gas meter is to be measured an accuracy of $\pm 1^\circ\text{F}$. Flow is to be converted from Actual line conditions to Standard conditions. Compressibility of the fuel will be determined using the performance test fuel analysis and AGA8.

C. Engine Inlet Air Conditions

Ambient Dry, and Wet Bulb temperatures are to be measured with a psychrometer shielded from direct sunlight. Relative Humidity is to be determined using a psychometric chart.

Compressor Inlet Temperature (T2) will be measured using the two RTDs located at the inlet of the compressor. Expected uncertainty relative to true mean engine inlet temperature is $\pm 1.0^\circ\text{F}$.

Barometric pressure at the test site shall be measured with a barometer accurate to ± 0.015 inches of mercury.

The engine inlet air relative humidity will be equivalent to the Ambient Relative Humidity. If the ambient air is cooled or heated, the engine inlet humidity shall then be determined using the ambient dry bulb temperature, compressor inlet temperature and a psychometric chart. A total accuracy of ± 0.001 -inlet water/air



ratio is expected.

Engine inlet pressure loss shall be measured with a slack tube manometer with one line installed on the dragon valve of the P0 pressure transmitter and the other open to atmosphere. A total accuracy of ± 0.25 inches of water is assumed.

D. Engine Exhaust Static Pressure

For exhaust loss measurement a slack tube manometer will be utilized if a connection port is made available. The customer is responsible for supplying a $\frac{1}{4}$ " test port connection for exhaust loss measurement. GE does not typically provide test ports between the turbine exhaust and exhaust stack, SCR, or boiler.

Engine exhaust static pressure shall be measured at the discharge of the engine exhaust collector upstream of any heat recovery, catalytic converter or sound attenuation equipment. A total accuracy of ± 0.25 inches of water is assumed

Typically the measurements taken between the exhaust duct and stack will fluctuate greatly due to the short length of duct and turbulent flow. Due to the fluctuating reading, an accurate exhaust loss reading may not be achievable. Should this be the case, the design value for exhaust loss will be used. That is, essentially not making a correction for exhaust loss.

E. NOx Water Injection

NOx water injection flow is measured via a turbine flow meter. The water temperature at the flow meter is measured with an RTD. The accuracy of the measurement and readout is ± 0.5 percent for water flow.

V. ENGINE LIMIT ASSESSMENT

The following Unit Control Limit Parameters are to be recorded during the performance test for engine limit assessment:

- High Pressure Rotor speed, XN25
- H. P. Compressor Discharge Pressure, PS3
- H. P. Compressor Discharge Temperature, T3
- Low Pressure Turbine Inlet Temperature, T48

VI. TEST EXECUTION

The GE Energy Performance Engineer has the overall responsibility for starting and stopping test, for directing plant operation and the test personnel, and for all other aspects of the test execution. However, the test director may not deviate from the test plan without prior mutual agreement by all parties to the test.



A. Unit Operating Conditions

1. **Permissible Mode of Unit Control:**

All Unit components will be operating within the respective manufacturer's specified continuous operating limits at base load. Test data will be recorded only when GTG is at base load and at a control limit (T3, PS3, T48, and/or XN25R3), and all test instrumentation are functioning satisfactory and in steady state condition for at least 1 hour to 30 minutes prior to testing. Please Note: If unit is in XNSD control, MW Limit Control, and/or Maximum or Minimum Fuel Control, then the performance test will not be conducted.

2. **Operating Status of GTG Package Auxiliary Loads:**

The test should be conducted with normal auxiliary package service loads in operation. All GTG Package Auxiliary and BOP equipment loads are to be excluded from this performance test.

3. **Emissions:**

During the performance test, NO_x water injection is to be used to maintain the guaranteed NO_x emission rate of the Guarantee

B. Permissible Variable Deviations During Test Runs

1. **Typical Performance Test Restart Situation:**

Any deviation outside of the following limits will require at restart of the performance test from that point forward until a complete 50-minute test has been completed and the permissible variable deviations are within the limits listed.

- Compressor Inlet Temperature $\pm 4.0^{\circ}\text{F}$
- Barometric Pressure $\pm 0.5\%$
- Power Output $\pm 2.0\%$

2. **Typical Performance Test Abort Situation:**

- SPRINT must be online for the performance test, if SPRINT flow goes offline during the performance test, then the test will be aborted.
- NO_x water must be online during the performance test. If NO_x water injection goes offline during the performance test, then the test will be aborted.
- The unit must be at base load with all systems operating (SPRINT, NO_x Injection, Inlet Heater if applicable; Inlet Chiller if applicable; gas compressors if applicable). If any one of these systems go offline during the performance test, then the test will be aborted.
- If the unit trips offline for any reason, then the test will be aborted.
- If either GTG goes into Maximum or Minimum Fuel Control, then the test will be aborted.



The performance test will be restarted as soon as the problem leading up to the abort situation is rectified.

VII. PERFORMANCE MEASUREMENT AND CORRECTION

The Gas Turbine Generators are designed and guaranteed to produce a certain output with a certain heat rate for a given set of ambient and operating conditions. As the ambient conditions deviate from the design values, the actual performance of the GTG changes. The ambient conditions at the time of testing are likely to be different from the values stated in the basis of guarantee. To account for these deviations from design ambient conditions, site-specific corrections will be applied to the raw data to derive equivalent design condition results.

A. Methodology for Data Reduction

Procedure to be used in the calculation of corrected results:

Where,

**Gross Corrected Power = Measured Power at GT Generator Terminals Corrected
for the Parameters Listed Appendix II, Section A**

**Gross Corrected Heat Rate = Calculated Gross Heat Rate Corrected for the
Parameters Listed Appendix II, Section A**

B. Method and criteria for evaluation of test results with regard to guaranteed performance

GE Energy will evaluate test data once test fuel analyses are received. Test data correction is performed in accordance with General Electric "Gas Turbine Site Performance Test and Correction Procedure", GE Energy document #SSPCP6000-A.

When compliance decisions are required based on the test, the parties involved must recognize the total tolerance due to measurement uncertainties associated with each particular test result.

Each measured test parameter's tolerance is defined as twice the estimated standard deviation (2 sigma). The uncertainty in the compliance parameter resulting from this tolerance is calculated for each measured test parameter. These uncertainties are then combined by root-sum-square analysis to obtain the total uncertainty for that compliance parameter. *Table 2* illustrates typical uncertainty calculations. The unit will be considered acceptable when the corrected test results are equal or better than the guaranteed value with allowance for test uncertainty.



A full test report will be issued to the customer two weeks after the fuel analysis has been received.

Example: Table 1: Accuracy of Required Instruments

Instruments	Customer	GE Energy	Recommended
Dry Engine Operation			
Recording wattmeter	X		±0.5%
Potential transformers	X		±0.3%
Current transformers		X	±0.3%
GT thermocouple system		X	±3.0°F
Primary fuel gas meter		X	±0.8 %
Fuel gas sampling device	X		Lab
Fuel gas pressure sensor		X	±0.25%
Fuel gas temperature sensor		X	±1.0°F
Engine inlet temperature (2)		X	±1.°F
Ambient air thermocouples	X		±1.°F
Barometer	X		±0.015 in Hg.
Ambient air psychrometer	X		±1.°F
Inlet plenum manometer	X		±0.25in. H2O
Exhaust duct manometers	X		±0.25in. H2O
Water Injection			
NOx water flow meter		X	±0.5%
NOx water temperature		X	±1.0°F



Example: Table 2: Instrument Uncertainty

VARIABLE	UNITS	UNC	Ni	RSC	Fi ²	RSS
POWER AT TEST						
CONDITIONS						
WATT-HOUR METER	%	0.5	1	1	0.25	
PTs	%	0.3	3	1	0.0300	
CTs	%	0.3	3	1	0.0300	
MEASURED POWER UNC					0.3100	0.5568
CORRECTED POWER						
MEASURED POWER					0.3100	
COMP INLET TEMP	°F	1.0	2	0.266	0.0353	
BAROMETER	PSIA	0.007	1	0.046	0.0000	
INLET LOSS	inH2O	0.25	1	0.082	0.0004	
EXHAUST LOSS	inH2O	0.25	1	0.025	0.0000	
WATER INJECTION FLOW	lb/lb	0.539	1	0.034	0.0003	
CONTROL TEMP	°F	1.5	8	0.072	0.0014	
SPEC. HUMIDITY	%	0.001	1	2.117	0.0000	
CORRECTED POWER UNC					0.3476	0.5896
HEAT RATE (GAS FUEL)						
AT TEST CONDITIONS						
FLOW METER	%	0.50	1	1	0.2500	
FUEL TEMP	%	0.20	1	1	0.0400	
FUEL PRESSURE	%	0.25	1	1	0.0625	
FUEL ANALYSIS	%	0.50	1	1	0.2500	
MEASURED POWER	%				0.3100	
MEASURED HEAT RATE UNC					0.9125	0.9552
CORRECT HEAT RATE						
MEASURED HEAT RATE					0.9125	
COMP INLET TEMP	°F	1	2	0.063	0.0020	
BAROMETER	PSIA	0.007	1	0.031	0.0000	
INLET LOSS	inH2O	0.25	1	0.031	0.0001	
EXHAUST LOSS	inH2O	0.25	1	0.025	0.0000	
SPEC. HUMIDITY	%	0.001	1	0.141	0.0000	
WATER INJECTION FLOW	lb/lb	0.539	1	0.020	0.0001	
CORRECT HEAT RATE UNC					0.9146	0.9564

Legend - UNC = measurement uncertainty; Ni = number of instruments; RSCi = sensitivity coefficient; Fi = (RSCi * UNCi/sqrtNi)²; RSS = Root sum square Root sum square



GE ENERGY SUMMARY COMMENTS TO ASME PTC-22 1997 RELEASE

PERFORMANCE TEST CODE FOR GAS TURBINE POWER PLANTS

SECTION 1 – OBJECT AND SCOPE

- 1.1.1 Documents describing testing and correction procedures will be provided for customer review and comment. Performance adjustment procedures will be made in accordance with GE's current recommendations.
- 1.3.1 Performance correction procedures will show typical uncertainties based on unit configuration and instruments used in the test.
- 1.3.2 A post-test uncertainty analysis is not included in the GE Scope of supply.

SECTION 2 - DEFINITIONS AND DESCRIPTION OF TERMS

- 2.1.9 Gas turbine power plant nomenclature shall be designated by the gas turbine manufacturer. A reference table will be provided to show gas turbine designated station codes.

SECTION 3 - GUIDING PRINCIPLES

- 3.1.1.i GE Energy does not specify a particular laboratory for fuel analysis but does designate the scope of the fuel analysis and applicable standards.
- 3.1.1.k If controls or instrumentation are found to be incorrectly adjusted during test, then parties will agree on a method to adjust the erroneous data or data will be rejected and the test will be rerun.
- 3.1.1.o Optional tests shall be specified in the contract.
- 3.1.1.q The test will be conducted at the prevailing ambient conditions with output adjusted near the guaranteed conditions.
- 3.2.1 The physical condition of the gas turbine, generator and ancillary equipment must be in new and clean condition. The manufacturer's test engineer will have sole authority to decide whether the equipment meets this requirement.



- 3.2.3 Calibration certificates shall be provided with all calibrated devices.
- 3.3.2 Steady state operating parameters are defined in Specification for Gas Turbine Generator Performance Test Measurement (SGTGPTM), Page 2, Section C.
- 3.3.3 Ambient condition variation limits described in the "Specification for Gas Turbine Generator Performance Test Measurement" (SGTGPTM) shall be the maximum allowable variations.
- 3.3.4 Sufficient data to evaluate the performance of the GE Energy turbine generator set will be collected within a 50 minute period consisting of six test points.
- 3.4.3 The customer will provide two personnel to record data, during the test, on the data log sheets provided by GE Energy. The GE Energy representative will supervise this data collection.

SECTION 4 - INSTRUMENTS AND METHODS OF MEASUREMENT

- 4.2.1.d Calibrated fuel metering equipment is supplied as described in GE Energy's Technical Proposal. LM2x, LM6000, and LMS100 packages with Single Annular Combustor (SAC) include a vortex-shedding meter. Packages with DLE combustors do not include a fuel meter. Fuel flow is measured via flow metering valves. The accuracy of these flow metering valves do not meet the required specification for performance test fuel measurement. Therefore the owner is responsible to provide a fuel-measuring device, with an accuracy of $\pm 0.5\%$ or better.
- 4.2.1.f On-site gas fuel analysis equipment is not furnished on GE Energy equipment.
- 4.4.2 Generator excitation power is produced by a permanent magnet generator attached to the main generator shaft and does not influence power at the generator terminals. Power is guaranteed at generator terminals and no deduction is made for other auxiliary loads not specified in "The Basis of Guarantee".
- 4.4.6 A three phase wattmeter is used in lieu of individual meters.
- 4.6.1 The wattmeter utilized has an accuracy of $\pm 0.50\%$.
- 4.8.1 Instrument transformers are calibrated by the manufacturer.
- 4.8.4 The wattmeter is verified and calibrated prior to the field test only.
- 4.11.1 The flow measurement system is calibrated to ensure an error of less than $\pm 0.9\%$.
- 4.11.3 Liquid fuel viscosity measured at two temperatures is adequate to allow interpolation of other temperatures.



4.11.6 LHV is determined by lab analysis.

4.12.2 Gas fuel consumption is measured using calibrated fuel metering equipment as described in the GE Energy Technical Proposal or by customer furnished fuel measuring device. See paragraph 4.2.1.d. Temperature and pressure of the fuel gas are also measured in accordance with the flow meter manufacturer specifications. A microprocessor calculated fuel flow utilizing the meter K-factor, meter frequency, fuel temperature, fuel pressure and fuel specific gravity as inputs. Additionally, these items are independently recorded at test time.

4.12.4,5,6,7 Laboratory analysis of fuel heating value is used for test evaluations.

4.13.1 U-tube manometers may have bores of less than 5/16". Accuracy of manometers may exceed 0.5%.

4.13.2 Dead-weight gauges are not used. Pressure gauges are only calibrated at the manufacturer. Calibrations are verified at the GE Energy factory during testing. Acceptable accuracy is $\pm 1.0\%$.

4.13.3 Static inlet pressure is measured at one point aft of all silencing apparatus and prior to the bellmouth foreign object damage screen. The static pressure tap may be larger than 1/16" and longer than 2.5 times the taphole diameter.

4.13.4 Barometric pressure and inlet static pressure is used to obtain inlet pressure.

4.13.5 Outlet Pressure will only be measured if appropriate taps are provided. Otherwise, calculations will be based on "the Basis of Guarantee"

4.14.2 The compressor inlet temperature is measured by two RTD's with an error of $\pm 1.0^{\circ}\text{F}$ and a combined accuracy of $\pm 0.9^{\circ}\text{F}$.

4.14.3 The error for inter-stage exhaust temperature thermocouples is $\pm 3.0^{\circ}\text{F}$.

4.14.4 Heat rejection measurements will be identified in "The Basis of Guarantee", otherwise none will be made.



SECTION 5 – COMPUTATION OF RESULTS

5.2 COMPUTATION OF POWER OUTPUT

5.3 CORRECTION OF TEST RESULTS TO RATED OR STANDARD CONDITIONS

5.4.6 Correction curves are applicable when the unit is operating on limits.

SECTION 6 – TEST REPORT REQUIREMENTS

6.c.3 Schematics are not included in the test report.

Attachment 9 Stamped Guarantee Sheet

(See Attached)



GUARANTEE

PROJECT: MMC ENERGY - ENERGY UPGRADE PROJECT
LOCATION: CHULA VISTA, CAUNIT NET, KW
BTU/KW-HR, LHV
(KJ/KW-HR, LHV)47034
8796
9279Jennifer Woods Mikolas
Performance Engineer
Date: 12/21/07EMISSIONS ARE VALID FOR T2 WITHIN 30F-100F
AND A GTG LOAD DOWN TO 50%
NOX: 25 PPMVD AT 15% O₂
(51 mg/Nm³)
CO: 104 PPMVD AT 15% O₂
(130 mg/Nm³)
VOC*: 3.2 PPMVD AT 15% O₂
(2 mg/Nm³)

NOT VALID WITHOUT SIGNATURE

VALID UNTIL 03/16/08

BASIS OF GUARANTEE:

BASE LOAD, GAS FUEL NOZZLE SYSTEM

NO BLEED OR EXTRACTED POWER

ENGINE:

(1) GE LM6000PC-SPRINT W/ FIGV AT -5 DEGREES GAS TURBINE

FUEL:

20630Btu/lb / (47985 kJ/kg) LHV, GAS FUEL (#900-1690)

FUEL SPEC:

MID-TD-0000-1 LATEST REVISION

FUEL TEMP:

MAXIMUM FUEL TEMPERATURE 250°F (121.1°C)

GENERATOR:

BDAX 290ERT

GENERATOR OUTPUT

13.8kV, 60 Hz

POWER FACTOR:

≥ 0.9

AMBIENT TEMP:

82.0°F / (27.8°C)

AMBIENT RH:

40.0 %

INLET CONDITIONING:

EVAP TO 67.6°F / (19.8°C) AT 87.5 % RH

ALTITUDE:

57.0ft / (17.4m)

INLET FILTER LOSS:

≤ 4.50 inH₂O / (114.3 mmH₂O)

EXHAUST LOSS:

≤ 12.00 inH₂O / (304.8 mmH₂O)

SPRINT WATER FLOW:

NOT TO EXCEED 10505 lb/hr

NOX CONTROL:

WATER

INJECTION RATE:

17217 lb/hr / (7810kg/hr) ±20 % FLOW

INJECTION TEMP:

100 °F/(37.8 °C)

ENGINE CONDITION:

NEW AND CLEAN ≤ 200 SITE FIRED HOURS

FIELD TEST METHODS

PERFORMANCE:

GE ENERGY SGTGPTM

NOX:

EPA METHOD 20

CO:

EPA METHOD 10

VOC:

EPA METHOD 25A/18

BASIS OF GUARANTEE IS NOT FOR DESIGN, REFER TO PROJECT DRAWINGS FOR DESIGN REQUIREMENTS.

SI VALUES ARE FOR REFERENCE PURPOSES ONLY.

*REFER TO ADDITIONAL CONDITIONS FOR SPECIFIC EMISSIONS GUARANTEE

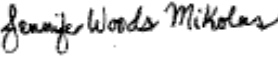
THIS GUARANTEE SUPERSEDES ANY
PREVIOUS GUARANTEES PRESENTED



GUARANTEE

PROJECT: MMC ENERGY - ENERGY UPGRADE PROJECT
LOCATION: CHULA VISTA, CA

UNIT NET, KW 47034
BTU/KW-HR, LHV 8796
(KJ/KW-HR, LHV) 9279


Jennifer Woods Mikolas
Performance Engineer
Date: 12/21/07

NEAR FIELD NOISE:

85 DBA AVERAGE SOUND PRESSURE
LEVEL (DB REF 20 MICROPASALS, RMS)
AT LOCATIONS AROUND THE PACKAGE
(VERTICAL DISTANCE OF 5FT. ABOVE
GRADE AT A HORIZONTAL DISTANCE OF
3FT. FROM THE EXTERIOR PLANE OF
EQUIPMENT AS TESTED IN A FREE-FIELD
CONDITION OVER A HARD REFLECTING
GROUND PLANE)

THIS GUARANTEE COINCIDES WITH
THE PREVIOUS GUARANTEE ISSUED
ON 12/21/2007

702846-100-CGER-N/A-R6

NOT VALID WITHOUT SIGNATURE

VALID UNTIL 03/16/08

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(1) GE LM6000PC-SPRINT W/ FIGV AT -5 DEGREES GAS TURBINE
FUEL:	20630Btu/lb / (47985 kJ/kg) LHV, GAS FUEL (#900-1690)
FUEL SPEC:	MID-TD-0000-1 LATEST REVISION
FUEL TEMP:	MAXIMUM FUEL TEMPERATURE 250°F (121.1°C)
GENERATOR:	BDAX 290ERT
GENERATOR OUTPUT	13.8kV, 60 Hz
POWER FACTOR:	≥ 0.9
AMBIENT TEMP:	82.0°F / (27.8°C)
AMBIENT RH:	40.0 %
INLET CONDITIONING:	EVAP TO 67.6°F / (19.8°C) AT 87.5 % RH
ALTITUDE:	57.0ft / (17.4m)
INLET FILTER LOSS:	≤ 4.50 inH ₂ O / (114.3 mmH ₂ O)
EXHAUST LOSS:	≤ 12.00 inH ₂ O / (304.8 mmH ₂ O)
SPRINT WATER FLOW:	NOT TO EXCEED 10505 lb/hr
NOX CONTROL:	WATER
INJECTION RATE:	17217 lb/hr / (7810kg/hr) ±20 % FLOW
INJECTION TEMP:	100 °F/(37.8 °C)
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
FIELD TEST METHODS	
NEAR FIELD NOISE:	GE NOISE TEST PROCEDURE/ASME PTC-36

BASIS OF GUARANTEE IS NOT FOR DESIGN, REFER TO PROJECT DRAWINGS FOR DESIGN REQUIREMENTS.
SI VALUES ARE FOR REFERENCE PURPOSES ONLY.

THIS GUARANTEE SUPERSEDES ANY
PREVIOUS GUARANTEES PRESENTED



GE ENERGY

Normal Operating Auxiliary Loads for 1xLM600060HZ PC-SPRINT 60Hz

December 17, 2007

STANDARD LOADS		
DESCRIPTION	QTY	
TURBINE AIR/OIL SEPARATOR	1	
GENERATOR ENCLOSURE VENT FAN	1	
TURBINE ENCLOSURE VENT FAN	1	
LIGHTING & LOW VOLTAGE DISTRIBUTION SYSTEM	1	
TOTAL STANDARD LOADS:		214

OPTIONAL LOADS		
DESCRIPTION	QTY	
SPRINT WATER SUPPLY PUMP	1	
WATER INJECTION PUMP - GAS FUEL (LP)	1	
EVAPORATIVE COOLER WATER RECIRC PUMP	2	
OIL COOLER FAN	1	
TOTAL OPTIONAL LOADS:		97

TOTAL LOADS: 310



GE ENERGY

Conditions for VOC Emissions Guarantee

1. Fuel must meet GE specification MID-TD-000-01.
2. The timing of test to coincide with lowest site ambient VOCs levels.
3. Gas turbine must run for a minimum of 300 total fired hours at base load prior to testing.
4. Gas turbine inlet and exhaust system must be free of any dirt,sand,mud,rust,oil or any other contaminates.
5. Re-testing (at purchaser's expense) must be allowed, if required.
6. GE receives a copy of the final test results.
7. A compressor wash prior to testing is highly recommended.

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN



GE Energy

Performance By: **Jennifer Woods Mikolas**
Project Info:

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G01250 - 8fk.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Site Gas Fuel#900-1690, 20630 Btu/lb,LHV**

Date: **12/20/2007**
Time: **4:29:06 PM**
Version: **3.6.0**

Case #	100	
Ambient Conditions		
Dry Bulb, °F	82.0	
Wet Bulb, °F	65.0	
RH, %	40.0	
Altitude, ft	57.0	
Ambient Pressure, psia	14.666	
Engine Inlet		
Comp Inlet Temp, °F	67.6	
RH, %	87.5	
Conditioning	EVAP	
Tons or kBtu/hr	0	
Pressure Losses		
Inlet Loss, inH2O	4.50	
Volute Loss, inH2O	4.00	
Exhaust Loss, inH2O	12.00	
kW, Gen Terms	47344	47034 kW, UNIT NET
Est. Btu/kW-hr, LHV	8606	8664 Est. Btu/kW-hr, LHV
Guar. Btu/kW-hr, LHV	8738	8796 Guar. Btu/kW-hr, LHV
Fuel Flow		
MMBtu/hr, LHV	407.5	
lb/hr	19751	
NOx Control	Water	
Water Injection		
lb/hr	17217	
Temperature, °F	100.0	
SPRINT	LPC	
lb/hr	9366	
Control Parameters		
HP Speed, RPM	10514	
LP Speed, RPM	3600	
PS3 - CDP, psia	439.5	
T3CRF - CDT, °F	983	
T48IN, °R	2038	
T48IN, °F	1578	
Exhaust Parameters		
Temperature, °F	854.5	
lb/sec	285.0	
lb/hr	1026160	
Energy, Btu/s- Ref 0 °R	97630	
Energy, Btu/s- Ref T2 °F	59591	
Cp, Btu/lb-R	0.2791	
Emissions (NOT FOR USE IN ENVIRONMENTAL PERMITS)		
NOx ppmvd Ref 15% O2	25	
NOx as NO2, lb/hr	41	
CO ppmvd Ref 15% O2	9	
CO, lb/hr	8.61	
CO2, lb/hr	53307.66	
HC ppmvd Ref 15% O2	2	
HC, lb/hr	1.19	
SOX as SO2, lb/hr	0.00	

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN



GE Energy

Performance By: **Jennifer Woods Mikolas**
Project Info:

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G01250 - 8fk.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Site Gas Fuel#900-1690, 20630 Btu/lb,LHV**

Date: **12/20/2007**
Time: **4:29:06 PM**
Version: **3.6.0**

Case # 100

Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	1.2140
N2	71.1934
O2	14.4631
CO2	5.1949
H2O	7.9309
SO2	0.0000
CO	0.0008
HC	0.0001
NOX	0.0027

Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	0.9672
N2	80.8857
O2	14.3862
CO2	3.7570
H2O	0.0000
SO2	0.0000
CO	0.0010
HC	0.0002
NOX	0.0028

Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	0.8483
N2	70.9449
O2	12.6181
CO2	3.2953
H2O	12.2898
SO2	0.0000
CO	0.0008
HC	0.0002
NOX	0.0024

Aero Energy Fuel Number 900-1690 (MMC)

	Volume %	Weight %
Hydrogen	0.0000	0.0000
Methane	96.1149	91.5599
Ethane	1.8016	3.2168
Ethylene	0.0000	0.0000
Propane	0.3049	0.7983
Propylene	0.0000	0.0000
Butane	0.1043	0.3600
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0024	0.0103
Cyclopentane	0.0000	0.0000
Hexane	0.0274	0.1402
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	1.2421	3.2461
Nitrogen	0.4018	0.6684
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	20630	
Btu/scf, LHV	918	
Btu/scf, HHV	1018	
Btu/lb, HHV	22873	
Fuel Temp, °F	125.0	
NOx Scalar	1.000	
Specific Gravity	0.58	

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN



GE Energy

Performance By: **Jennifer Woods Mikolas**
Project Info:

Engine: **LM6000 PC-SPRINT w/ FIGV at -5 Degrees**
Deck Info: **G01250 - 8fk.scp**
Generator: **BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)**
Fuel: **Site Gas Fuel#900-1690, 20630 Btu/lb,LHV**

Date: **12/17/2007**
Time: **4:25:51 PM**
Version: **3.6.0**

Case #	100	
Ambient Conditions		
Dry Bulb, °C	27.8	
Wet Bulb, °C	18.3	
RH, %	40.0	
Altitude, m	17.4	
Ambient Pressure, kPa	101.118	
Engine Inlet		
Comp Inlet Temp, °C	19.8	
RH, %	87.5	
Conditioning	EVAP	
Tons or kBtu/hr	0	
Pressure Losses		
Inlet Loss, mmH2O	114.30	
Volute Loss, mmH2O	101.60	
Exhaust Loss, mmH2O	304.80	
kW, Gen Terms		
	47344	47034 kW, UNIT NET
Est. kJ/kWh, LHV	9080	9140 Est. kJ/kWh, LHV
Guar. kJ/kWh, LHV	9219	9279 Guar. kJ/kWh, LHV
Fuel Flow		
GJ/hr, LHV	429.9	
kg/hr	8959	
NOx Control		
Water		
Water Injection		
kg/hr	7810	
Temperature, °C	37.8	
SPRINT		
kg/hr	LPC	
	4249	
Control Parameters		
HP Speed, RPM	10514	
LP Speed, RPM	3600	
PS3 - CDP, kPa	3030.5	
T3CRF - CDT, °C	528	
T48IN, °K	1132	
T48IN, °C	859	
Exhaust Parameters		
Temperature, °C	456.9	
kg/sec	129.3	
kg/hr	465463	
Energy, KJ/s- Ref 0 °K	103005	
Energy, KJ/s- Ref T2 °C	62872	
KJ/kg-R	1.1683	
Emissions (NOT FOR USE IN ENVIRONMENTAL PERMITS)		
NOx mg/Nm3 Ref 15% O2	51	
NOx as NO2, kg/hr	19	
CO mg/Nm3 Ref 15% O2	11	
CO, kg/hr	3.91	
CO2, kg/hr	24180.20	
HC mg/Nm3 Ref 15% O2	2	
HC, kg/hr	0.54	
SOX as SO2, kg/hr	0.00	

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN



GE Energy

Performance By: Jennifer Woods Mikolas
Project Info:

Engine: LM6000 PC-SPRINT w/ FIGV at -5 Degrees
Deck Info: G01250 - 8fk.scp
Generator: BDAX 290ERT 60Hz, 13.8kV, 0.9PF (14839)
Fuel: Site Gas Fuel#900-1690, 20630 Btu/lb,LHV

Date: 12/17/2007
Time: 4:25:51 PM
Version: 3.6.0

Case # 100

Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	1.2140
N2	71.1934
O2	14.4631
CO2	5.1949
H2O	7.9309
SO2	0.0000
CO	0.0008
HC	0.0001
NOX	0.0027

Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	0.9672
N2	80.8857
O2	14.3862
CO2	3.7570
H2O	0.0000
SO2	0.0000
CO	0.0010
HC	0.0002
NOX	0.0028

Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	0.8483
N2	70.9449
O2	12.6181
CO2	3.2953
H2O	12.2898
SO2	0.0000
CO	0.0008
HC	0.0002
NOX	0.0024

Aero Energy Fuel Number 900-1690 (MMC)

	Volume %	Weight %
Hydrogen	0.0000	0.0000
Methane	96.1149	91.5599
Ethane	1.8016	3.2168
Ethylene	0.0000	0.0000
Propane	0.3049	0.7983
Propylene	0.0000	0.0000
Butane	0.1043	0.3600
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0024	0.0103
Cyclopentane	0.0000	0.0000
Hexane	0.0274	0.1402
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	1.2421	3.2461
Nitrogen	0.4018	0.6684
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000
kJ/kg, LHV	47985	
kJ/Nm3, LHV	36048	
kJ/Nm3, HHV	39967	
kJ/kg, HHV	53201	
Fuel Temp, °C	51.7	
NOx Scalar	1.000	
Specific Gravity	0.58	

Attachment 10 Seller Equal Employment Opportunity Certificate

(See Attached)

FEDERAL GOVERNMENT CONTRACT COMPLIANCE
CERTIFICATION AND AGREEMENT

The undersigned agrees that, as to all current contracts and purchase orders, as defined below, heretofore issued or entered into by _____ as purchaser, (hereinafter known as "Purchaser") for the furnishing of supplies or services by the undersigned Company, and as to each such contract and purchase order, as defined below, which may hereafter be issued or entered into by the Purchaser in favor of the undersigned at any time within one (1) year following the date of this agreement, the undersigned will comply with the provisions shown below, provided said provisions are in effect; and the undersigned further agrees that while the said provisions are in effect, without further reference thereto, the said provisions are and shall be automatically a part of the supplement to each such past and future contract and purchase order, as defined below, to be binding upon the undersigned, its successors and assigns to the same extent, effect and purpose as if physically incorporated into such past and future contract and purchase order and copied therein.

For purposes of this agreement, the words "Contract" and "Purchase Order" shall mean any agreement or arrangement between the Purchaser and the undersigned for the furnishing of supplies or services or for the use of real or personal property, including lease arrangements, which, in whole or in part, are necessary to the performance of any one or more contracts between the Purchaser and the United States of America or under which any portion of the Purchaser's obligation under any one or more such contracts is performed, undertaken, or assumed.

A. AGREEMENTS

1. Equal Opportunity Clause

With respect to all Contracts or Purchase Orders for \$10,000 or more, the undersigned shall be bound by and agrees to the following provisions as set forth in Section 202 of Executive Order 11246 and Section 60-1.4 of Title 41 of the Code of Federal Regulations, to wit:

- a. The undersigned will not discriminate against any employee or applicant for employment because of race, color, religion, or national origin. The undersigned will take affirmative action to

ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer, recruitment or recruitment advertising, lay-off or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The undersigned agrees to post in conspicuous places available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this non-discrimination clause.

- b. The undersigned will, in all solicitations or advertisements for employees placed by or on behalf of the undersigned, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
- c. The undersigned will send to each labor union or representative of workers with which he has a collective bargaining agreement or contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers representative of the undersigned's commitment under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
- d. The undersigned will comply with all provisions of Executive Order No. 11246 of September 24, 1965, and the rules, regulations and relevant orders of the Secretary of Labor.
- e. The undersigned will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations and orders.
- f. In the event of the undersigned's non-compliance with the non-discrimination clauses of this contract or with any of such rules, regulations or orders, this contract may be canceled, terminated, or suspended in whole or in part and the undersigned may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of September 24, 1965, and such other sanctions may be imposed

and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulations, or order of the Secretary of Labor, or as otherwise provided by law.

- g. The undersigned will include the provisions of Paragraphs (a) through (g) in every sub-contract or purchase order unless exempted by rules, regulations or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each sub-contractor or vendor. The undersigned will take such action with respect to any sub-contract or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for non-compliance; provided however, that in the event the undersigned becomes involved in, or is threatened with litigation with a sub-contractor or vendor as a result of such direction by the contracting agency, the undersigned may request the United States to enter into such litigation to protect the interests of the United States.

2. Employment of Veterans -- Listing of Employment Openings

Pursuant to Executive Order No. 11701 and the Vietnam Era Veteran's Readjustment Assistance Act of 1974, with respect to all Contracts or Purchase Orders for \$10,000 or more, the undersigned (referred to in the following clause as the Contractor) shall be bound by and agrees to the following provisions as set forth in Section 60-250.4 of Title 41 of the Code of Federal Regulations, to wit:

- a. The contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam Era in regard to any position for which the employee or applicant for employment is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified disabled veterans and veterans of the Vietnam Era without discrimination based upon their disability or veterans status in all employment practices such as the following: employment upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.
- b. The contractor agrees that all employment openings of the contractor which exist at the time of the execution of this contract and those which occur during the performance of this contract, including those not generated by this contract and including those

occurring at an establishment of the contractor other than the one wherein the contract is being performed but excluding those of appropriate local office of the State employment service system wherein the opening occurs. The contractor further agrees to provide such reports to such local office regarding employment openings and hires as may be required.

State and local government agencies holding Federal contracts of \$10,000 or more shall also list all their suitable openings with the appropriate office of the State employment service, but are not required to provide those reports set forth in paragraphs (d) and (e).

- c. Listing of employment openings with the employment service system pursuant to this clause shall be made at least concurrently with the use of any other recruitment source or effort and shall involve the normal obligations which attach to the placing of a bona fide job order, including the acceptance of referrals of veterans and non-veterans. This listing of employment openings does not require the hiring of any particular job applicant or from any particular group of job applicants, and nothing here is intended to relieve the contractor from any requirements in Executive Orders or regulations regarding non-discrimination in employment.
- d. The reports required by paragraph (b) of this clause shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office or, where the contractor has more than one hiring location in a State, with the central office of that State employment service. Such reports shall indicate for each hiring location (1) the number of individuals hired during the reporting period, (2) the number of non-disabled veterans of the Vietnam Era hired, (3) the number of disabled veterans of the Vietnam Era hired, and (4) the total number of disabled veterans hired. The reports should include covered veterans hired for on-the-job training under 38 USC 1787. The contractor shall submit a report within 30 days after the end of each reporting period wherein any performance is made on this contract identifying data for each hiring location. The contractor shall maintain at each hiring location copies of the reports submitted until the expiration of one year after final payment under the contract, during which time these reports and related documentation shall be made available, upon request, for examination by any authorized representatives of the contracting officer or the Secretary of Labor.

Documentation would include personnel records respecting job openings, recruitment and placement.

- e. Whenever the contractor becomes contractually bound to the listing provisions of this clause, it shall advise the employment service system in each State where it has establishments of the name and location of each hiring location in the State. As long as the contractor is contractually bound to these provisions and has so advised the State system, there is no need to advise the State system of subsequent contracts. The contractor may advise the State system when it is no longer bound by this contract clause.
- f. This clause does not apply to the listing of employment openings which occur and are filled outside of the 50 states, the District of Columbia, Puerto Rico, Guam, and the Virgin Islands.
- g. The provisions of paragraphs (b), (c), (d) and (e) of this clause do not apply to openings which the contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement. This exclusion does not apply to a particular opening once an employer decides to consider applicants outside of his own organization or employer-union arrangement for that opening.
- h. As used in this clause: (1) "All employment openings" includes all positions except executive and top management, those positions that will be filled from within the contractor's organization, and positions lasting three days or less. This term includes full-time employment, temporary employment of more than three days' duration, and part-time employment.
 - (2) "Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility for serving the area where the employment opening is to be filled, including the District of Columbia, Guam, the Commonwealth of Puerto Rico, and the Virgin Islands.
 - (3) "Positions that will be filled from within the contractor's organization" means employment openings for which no consideration will be given to persons outside the contractor's organization (including any affiliates, subsidiaries, and the parent companies) and includes any openings which the contractor proposes to fill from regularly established "recall" lists. The exception does not apply to a

particular opening once an employer decides to consider applicants outside of his or her own organization.

- i. The contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.
- j. In the event of the contractor's non-compliance with the requirements of this clause, actions for non-compliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.
- k. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the contracting officer. Such notice shall state the contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam Era for employment, and the rights of applicants and employees.
- l. The contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding that the contractor is bound by the terms of the Vietnam Era Veterans Readjustment Assistance Act, and is committed to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era.
- m. The contractor will include the provisions of this clause in every sub-contract or purchase order of \$10,000 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to the Act, so that such provisions will be binding upon each sub-contractor or vendor. The contractor will take such action with respect to any sub-contract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for non-compliance.

3. Employment of the Handicapped

Pursuant to the Rehabilitation Act of 1973 and Executive Order No. 11758, with respect to all Contracts or Purchase Orders for \$2,500 or more, (except as further limited below), the undersigned (referred to in the following clause as the Contractor) shall be bound by and agrees to

the following provisions as set forth in Section 741.4 Part 60-741 of 41 CFR, to wit:

- a. The contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to any position for which the employee or applicant for employment is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.
- b. The contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.
- c. In the event of the contractor's non-compliance with the requirements of this clause, actions for non-compliance may be taken in accordance with the rules, regulations and relevant orders of the Secretary of Labor issued pursuant to the Act.
- d. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the contracting officer. Such notices shall state the contractor's obligation under the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.
- e. The contractor will notify each labor union or representative of workers with which it has a collective bargaining agreement or other contract understanding, that the contractor is bound by the terms of Section 503 of the Rehabilitation Act of 1973, and is committed to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.
- f. The contractor will include the provisions of this clause in every sub-contract or purchase order of \$2,500 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to Section 503 of the Act, so that such provisions will be binding upon each sub-contractor or vendor. The contractor will take such action with respect to any sub-contract or purchase

order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for non-compliance.

4. Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals

With respect to all contracts or purchase orders under federal government contracts expected to exceed \$500,000 (or in the case of construction of a public facility, \$1,000,000, where such federal government contract is required to contain either the clause "Small Business and Small Disadvantaged Business Subcontracting Plan (Negotiated)" or the clause "Small Business and Small Disadvantaged Business Subcontracting Plan (Advertised)", and where such contract or purchase order offers further subcontracting opportunities, pursuant to Executive Order 11625 and Section 211 of Pub. L. 95-507, the undersigned (referred to in the following clause as the contractor) shall be bound by and agrees to the following provisions as set forth in OFPP Policy Letter 80-2 (45 Fed. Reg. 31028, May 9, 1980), implemented by Supplement No. 2 to FRP Temporary Regulation No. 50 (45 Fed. Reg. 35809, May 28, 1980), as amended at 50 FR 27563, July 3, 1985: Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals.

- (a) It is the policy of the United States that small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals shall have the maximum practicable opportunity to participate in the performance of contracts led by any Federal agency, including contracts and subcontracts for subsystems, assemblies, components, and related services for major systems. It is further the policy of the United States that its prime contractors establish procedures to ensure the timely payment of amounts due pursuant to the terms of their subcontracts with small business concerns and small business concerns owned and controlled by socially and economically disadvantaged individuals.
- (b) The contractor hereby agrees to carry out this policy in the awarding of the subcontracts to the fullest extent consistent with the efficient performance of this contract. The contractor further agrees to cooperate in any studies or surveys as may be conducted by the Small Business Administration or the awarding

agency which may be necessary to determine the extent of the contractor's compliance with this clause.

- (c1) As used in this contract, the term "small business concern" shall mean a small business as defined pursuant to Section 3 of the Small Business Act and relevant regulations promulgated pursuant thereto.
- (c2) The term "small business concern owned and controlled by socially and economically disadvantaged individuals" shall mean a small business concern:
 - (i) which is at least 51 per centum owned by one or more socially and economically disadvantaged individuals; or in the case of any publicly owned business, at least 51 per centum of the stock of which is owned by one or more socially and economically disadvantaged individuals; and
 - (ii) whose management and daily business operations are controlled by one or more of such individuals.

The contractor shall presume that socially and economically disadvantaged individuals include Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, and other minorities, or any other individual found to be disadvantaged by the Small Business Administration pursuant to Section 8(a) of the Small Business Act.

- (d) Contractors acting in good faith may rely on written representations by their subcontractors regarding their status as a small business concern or a small business concern owned and controlled by socially and economically disadvantaged individuals."

5. Utilization of Women-Owned Business Concerns

With respect to all contracts or purchase orders under a federal government contract expected to exceed \$500,000 (or in the case of construction of any public facility, \$1,000,000, where such federal government contract is required to include the clause "Women-Owned Business Concerns Subcontracting Program (over \$500,000 or \$1,000,000 for Construction of Any Public Facility)", and where such contracts or purchase orders offer substantial subcontracting opportunities, the undersigned (referred to in the following clause as the Contractor) shall be bound by and agrees to the following

provisions as set forth in OFPP Policy Letter 80-4, 45 Fed. Reg. 31033, May 9, 1980, pursuant to Executive Order 12138:

"Utilization of Women-Owned Business Concerns

- (a) It is the policy of the United States Government that women-owned businesses shall have the maximum practicable opportunity to participate in the performance of contracts awarded by any Federal agency.
- (b) The contractor agrees to use his best efforts to carry out this policy in the award of subcontracts to the fullest extent consistent with the efficient performance of this contract. As used in this contract, a 'woman-owned business' concern means a business that is at least 51% owned by a woman or women who also control and operate it. 'Control' in this context means exercising the power to make policy decisions. 'Operate' in this context means being actively involved in the day-to-day management. 'Women' means all women business owners."

Women-Owned Business Concerns Subcontracting Program
(over \$500,000 or \$1,000,000 for Construction of Any Public Facility).

- (a) The contractor agrees to establish and conduct a program which will enable women-owned business concerns to be considered fairly as subcontractors and suppliers under this contract. In this connection, the contractor shall:
 - (1) Designate a liaison officer who will administer the contractor's 'Women-Owned Business Concerns Program'.
 - (2) Provide adequate and timely consideration of the potentialities of known women-owned business concerns in all 'make-or-buy' decisions.
 - (3) Develop a list of qualified bidders that are women-owned businesses and assure that known women-owned business concerns have an equitable opportunity to compete for subcontracts, particularly by making information on forthcoming opportunities available, by arranging solicitations, time for the preparation of bids, quantities, specifications, and

delivery schedules so as to facilitate the participation of women-owned business concerns.

- (4) Maintain records showing (i) procedures which have been adopted to comply with the policies set forth in this clause, including the establishment of a source list of women-owned business concerns; (ii) awards to women-owned businesses on the source list by minority and non-minority women-owned business concerns; and (iii) specific efforts to identify and award contracts to women-owned business concerns.
 - (5) Include the 'Utilization of Women-Owned Business Concerns' clause in subcontracts which offer substantial subcontracting opportunities.
 - (6) Cooperate in any studies and surveys of the contractor's women-owned business concerns, procedures and practices that the Contracting Officer may from time-to-time conduct.
 - (7) Submit periodic reports of subcontracting to women-owned business concerns with respect to the records referred to in subparagraph (4) above, in such form and at such time (not more often than quarterly) as the Contracting Officer may prescribe.
- (b) The contractor further agrees to insert, in any subcontract thereunder which may exceed \$500,000 or \$1,000,000 in the case of contracts for the construction of any public facility and which offers substantial subcontracting possibilities, provisions which shall conform substantially to the language of this clause, including this paragraph (b), and to notify the Contracting Officer of the names of such subcontractors.
- (c) The contractor further agrees to require written certification by its subcontractors that they are bona fide women-owned and controlled business concerns in accordance with the definition of women-owned business concerns as set forth in the Utilization Clause I(b) above at the time of submission of bids or proposals."

B. REPRESENTATIONS

1. Employer Information Report

The undersigned represents that it has filed an annual Employer Information Report EEO-1, Standard Form 100, and further represents that it has filed or will file such other reports as may be required by the Contracting Compliance Agency pursuant to Section 60-1.7 of Title 41 of the Code of Federal Regulations.

2. Written Affirmative Action Compliance Program

The undersigned represents that it has 50 or more employees and is covered by a federal government contract or sub-contract of \$50,000 or more, and represents that it has developed or will develop a written affirmative action compliance program for each of its establishments as required by Section 60-1.40 and Section 60-2 of Title 41 of the Code of Federal Regulations.

3. Previous Contracts

The undersigned represents that it has held previous contracts or subcontracts which are subject to the Equal Opportunity Clause of Executive Order No. 11246.

GENERAL ELECTRIC COMPANY

Gerald H. Parks

BY: Gerald H. Parks
Manager - Compliance Programs
Fairfield, CT 06431

Review Date: January, 2000

Attachment 11 Typical Document List and Schedule

(Some drawings listed below may not be applicable to specific projects)

Submittal Time (Weeks)

APPROVAL DRAWINGS (Submitted for Purchaser Approval)

General Arrangement, Main Unit ^{NOTE 3}	14
One Line Diagram ^{NOTE 3}	14

INFORMATION DRAWINGS (Provided for Purchaser Information only. Not for approval)

ELECTRICAL

Electrical Symbols, Abbreviations and Reference Data	8
Interconnect Plan, Electrical	10
Interconnect Wiring Diagram, Purchaser	12
Interconnect Cable Schedule	16
Plan & Elevation, Turbine Control Panel	12
Plans & Elevations, 24 VDC, 125 VDC, 240 VDC Battery Systems	8
Plans & Elevations, Lineside Cubicle, Neutral Cubicle	8
Three Line Diagram, Generator Metering	12
Schedule, Motor Control Center	8
Schematic Diagram, Motor Control Center	12
Schematic Diagram, Circuit Breaker Control Discrete Control	16
Schematic Diagram, Analog Control	16
Schematic Diagram, Circuit Breaker Control	12
System Schematic, Generator Excitation	12

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System Schematic, Lighting & Distribution	12
System Schematic, Critical Path Emergency Stop, DC Power	12
System Schematic, Communication	12
Instrument Loop Diagram, Hydraulic Start System	16
Instrument Loop Diagram, Ventilation & Combustion Air System.....	16
Instrument Loop Diagram, Synthetic Lube Oil System	16
Instrument Loop Diagram, Mineral Lube Oil System	16
Instrument Loop Diagram, Turbine Hydraulic System.....	16
Instrument Loop Diagram, Fire & Gas Protection System.....	16
Instrument Loop Diagram, Gas Fuel System.....	16
Instrument Loop Diagram, NO _x Water Injection System	16
Instrument Loop Diagram, Water Wash System	16
Instrument Loop Diagram, Vibration System.....	16
Instrument Loop Diagram, Auxiliary System.....	16
Generator Protective Relay Settings	16

MECHANICAL

General Arrangement, Air Filter ^{NOTE 3}	14
General Arrangement, Water Injection Skid ^{NOTE 3}	14
General Arrangement, Auxiliary Skid ^{NOTE 3}	14
Anchor Bolt & Shear Lug Detail (Main Unit) ^{NOTE 3}	14
Installation Footprint (Main Unit) ^{NOTE 3}	14
Lift Arrangement.....	16
Shipping Data	16

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Flow and Equipment Symbols, Mechanical	10
Flow and Instrument Diagrams (as applicable)	10
F&ID, Hydraulic Start System.....	10
F&ID, Ventilation and Combustion Air System.....	10
F&ID, Turbine Lube Oil System	10
F&ID, Gas Fuel System (DLE)	10
F&ID, Turbine Hydraulic System.....	10
F&ID, Fire Protection System (CO ₂) ^{NOTE 3}	16
F&ID, Water Wash System.....	10
F&ID, Water Injection Pump.....	10
Instrument Skid, Auxiliary Systems.....	10

REFERENCE DRAWINGS (Included in Operation and Maintenance Manuals)

Wiring Diagram, Turbine Control Panel, Control Cubicle

Wiring Diagram, Turbine Control Panel, Termination Cubicle

Wiring Diagram, Turbine Skid

Wiring Diagram, Auxiliary Skid

Wiring Diagram, Air Inlet Filter

Wiring Diagram, Generator Skid

Wiring Diagram, Lineside Cubicle

Wiring Diagram, Neutral Cubicle

Wiring Diagram, Fire & Gas Protection System

Nameplate List, Engraving Schedule, & Switch Development

Fuel Control Layout

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Worksheet, Fuel Control

Sequencer Layout

Worksheet, Distributed I/O Configuration

NOTES:

- 1) Submittal time is for standard equipment and is shown in weeks after receipt of a mutually agreed upon purchase order, a fully conformed design specification, and the post award Order Definition Meeting (ODM).
- 2) Custom designed features for specific project requirements may require additional submittal times.
- 3) Drawings denoted with "Note 3" are subject to drawing delay liquidated damages as outlined in Article 8.

Some of the above drawings may not be required on specific jobs. A drawing is considered submitted when uploaded to the www.projectnet.com site

Drawing Quantities and Format

Seller places Purchasers' drawings on ProjectNet, a secure internet site, (www.projectnet.com). On this site the drawings can be viewed, printed and annotated by the Purchaser.

Seller provides all manuals in CD format for convenient access and distribution. In addition, by using web-based technology Seller provides today's Purchasers with instant and secure access to their unit's operation and maintenance documentation with easy updates and "real time" information.

Attachment 12 Special Conditions for On-site Services

(Technical Advisory Services Only)

SC-S1. Definitions

- a) "Technical Advisors" or "Field Engineers" shall mean the personnel provided by the Seller who will perform Technical Advisory or Field Engineering Services.
- b) "Technical Advisory Services" or "Field Engineering Services" shall mean technical advice and counsel from Technical Advisors or Field Engineers provided by the Seller based on the Seller's current engineering, manufacturing, installation and operation practices as applicable to the Equipment. Such services may include testing, adjustment, programming and other similar services. Technical Advisory Services or Field Engineering Service do not include supervision or management of the Purchaser's employees, agents, or other contractors.
- c) "Work Scope" means the "Technical Advisory Services" or "Field Engineering Services" work scope included in Attachment 2, Scope of Supply.

SC-S2. Service Price Basis

The price for Technical Advisory Services is as set forth in Article 3. A current Technical Advisory Rate Sheet is attached here for reference.

SC-S3. Purchaser's Obligations At The Site

The Purchaser will render all reasonable assistance to the Seller's personnel at the Site, including the following matters at the Purchaser's cost (except as may be provided in the Contract or otherwise agreed in writing):

- a) Designated representative(s) to coordinate activities between the Seller, the Purchaser and the Purchaser's other contractors at the Site and to resolve procedures for certain activities where questions might occur. Such coordination shall include consultation with the Seller's representatives prior to arrival at Site as to the scheduling of all work associated with the Services. The Purchaser's representative will have immediate access to the Purchaser's warehousing and shop facilities.
- b) All drawings and specifications, technical information and equipment manuals required to perform the work scope and all protective relaying and relay settings, as appropriate.

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- c) Compressed air and all Site utilities in the amounts, pressures, and voltages required to perform the work scope, including adequate lighting for nightshift work.
- d) All required parts and miscellaneous materials (e.g., bolts, nuts, gaskets, steel plates, consumables, lube oil, hydraulic oil, etc).
- e) Heavy lift equipment, hand and power tools and instruments, oxy-acetylene welding machines. The Seller's personnel may bring certain tools, which will remain Seller's property. At the Purchaser's request, the Seller may make available certain special test or installation instruments/equipment under Seller's established rental provisions.
- f) Any labor, including labor supervision and equipment operators, that may be required in connection with the Services.
- g) Access to lay down space next to the equipment upon which the Services will be performed.
- h) Climate-controlled and secure office and storage space adjacent to the work area at the Site, including secretarial, clerical and translation assistance, copy machines, office supplies and equipment and appropriate telecommunications, such as, international and local telephone and fax services.
- i) Assistance in the procurement of all necessary visas and travel documents for Seller personnel including sponsorship of all Seller personnel to obtain entry and resident visas as required.
- j) The Purchaser shall arrange for the Seller to be covered under the Site property insurance policy.
- k) Adequate fire fighting equipment and services and site security, meaning the act of safeguarding the job site against sabotage, theft, arson, or any other dishonest or criminal act by physical means, such as guards, fencing, and lighting. This includes the safeguarding of all Seller tools, consumables, equipment and parts when provided.
- l) Personnel for erection, calibration and similar miscellaneous activities associated with the mechanical erection and commissioning of the Equipment.

SC-S4. Health and Safety Matters; Hazardous Materials

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- a) The Purchaser will take all necessary precautions, at all times, for the safety of the Seller's personnel at Site. This includes, but is not limited to, instruction of the Purchaser's safety practices, proper and safe handling of hazardous substances and protection of the Seller's personnel from exposure thereto, energization/de-energization of all power systems (electrical, mechanical and hydraulic) using a safe and effective lock-out tag procedure, and conducting periodic safety meetings during construction and start-up.
- b) The Seller may, from time to time, conduct safety audits to insure safe conditions exist and make recommendations to the Purchaser concerning same. Neither the conduct or non-conduct of safety audits nor the making of any recommendation by the Seller shall relieve the Purchaser of the responsibility to provide a safe place to work. If the Seller's personnel require medical attention, local Purchaser facilities will be made available to the Seller's personnel for the duration of such needs.
- c) If, in the Seller's opinion, the safe execution of Services at the Site is, or is apt to be, imperiled by local conditions, the Seller may remove some or all of its personnel from the Site and/or supervise performances of all or any part of its Services and/or evacuate its personnel and the Purchaser shall assist in said evacuation, any of which shall be considered to be an Excusable Delay.
- d) In general, Seller's personnel shall not be required to work more than (a) sixteen (16) hours in any one twenty-four (24) hour period, (b) eighty-four (84) hours in any one week period or (c) one hundred and forty-four (144) hours in any two week period.
- e) The operation of equipment at the Site is the responsibility of the Purchaser. If the Purchaser requires or permits the Seller's personnel to operate equipment at the Site, the Purchaser shall indemnify and save the Seller, its employees and agents, harmless from expense and liability (including reasonable attorneys' fees) incurred by or imposed upon the Seller, its employees and agents, based upon injury to persons (including death) or damage to property resulting from operation of equipment at the Site by the Seller's personnel.
- f) To ensure adequate performance of the Services and that the Seller's personnel are not extended beyond their capability, the Seller's personnel will not be required to work on other projects or equipment during the term of the Contract.
- g) If, at the Site, the Seller encounters toxic substances, hazardous substances or hazardous wastes (as such terms may be defined in any statute or ordinance or regulations promulgated by any federal, state or local governmental authority of the United States or the country of the Site) (collectively, the "Hazardous Materials") which require special handling and/or disposal, the Purchaser shall immediately take whatever precautions are required to legally eliminate such hazardous conditions so

that the work under the Contract may safely proceed. If any such Hazardous Materials cause an increase in the Seller's cost of or the time required for performance of any part of the work, an equitable adjustment shall be made in the price and schedule. The Purchaser agrees to properly dispose of all Hazardous Materials produced or generated in the course of the Seller's work at the Site. The Purchaser shall indemnify the Seller for any and all claims, damages, losses, causes of action, demands, judgments and expenses arising out of or relating to (i) the presence of any Hazardous Materials which are present on the Site prior to the commencement of Seller's work or (ii) improperly handled or disposed of by the Purchaser or (iii) brought on to the Site or produced thereon by parties other than the Seller.

SC-S5. Miscellaneous

Any information, suggestions or ideas transmitted by the Purchaser to the Seller in connection with performance hereunder are not to be regarded as secret or submitted in confidence except as may be otherwise provided in a writing signed by the Seller's duly authorized representative.

Technical Advisors and Field Engineers are not authorized to sign Change Orders on behalf of Seller. All Change Orders must be approved by the Project Manager in advance of work and reduced to a written agreement pursuant to Article 18 of the Contract.

In accordance with Article 5.3 of the Contract, Purchaser shall have no right to offset or backcharge hereunder.

Attachment 13 Special Conditions for Training Services

SC-T1. Definitions

Unless otherwise defined herein, all capitalized terms used in these Special and Conditions shall have the meanings assigned to them in the Contract Documents. "Purchaser's Personnel" means the employees of the company, which owns or operates the Facility, who are designated to receive training under this Contract. "Site" means the location where the training will be conducted.

SC-T2. Training Services Generally

- a) Each daily class (five (5) days/week) will be limited to six (6) hours. The actual class time during the morning and afternoon will be dictated by the availability of the equipment and the students per the Seller's normal work schedule. Each class time period shall be agreed to by the Purchaser's management and the Seller's instructor(s) no later than the beginning of each week. The six (6) hour class limitation is intended to give the instructors sufficient time to prepare the next session's work plan.
- b) English speaking instructor(s) will be furnished for the course duration. Any translation shall be provided by Purchaser at the Purchaser's expense.
- c) Each student will be furnished a suitable bound course instruction and reference handbook in English. During the training program, the Seller reserves the right to depart from the written instruction material to address more current subject material. Any materials furnished are exclusively for the use of the Purchaser's Personnel. This material is not for resale or to be distributed to third parties, nor is it to be copied or reproduced without Seller's prior written permission. Copies may be translated at the Purchaser's risk and expense only with the prior written consent of the Seller.
- d) Any audio or video recording of the Seller's lecture material is prohibited unless the Seller grants permission in writing in advance of the training program.
- e) Training aids, software, simulators, 35mm slides and transparencies supplied by the Seller during the training program will remain the property of the Seller.
- f) The Seller reserves the right to replace any instructor assigned to the Purchaser and to supply a qualified replacement at the Seller's expense. An overlap may be arranged when the Seller replaces an instructor.
- g) Any information, suggestions or ideas transmitted by the Purchaser to the Seller in connection with performance hereunder are not to be regarded as secret or

submitted in confidence except as may be otherwise provided in a writing signed by the Seller's duly authorized representative.

SC-T3. Suspension and Termination for Convenience

- a) If the Purchaser elects to suspend or delay Training Services, the Purchaser shall notify the Seller one week in advance of the date in writing, indicating the anticipated period and the reasons for the suspension. The Seller shall advise the Purchaser of the price adjustment resulting from the planned change of the training program. The price adjustment will be based on the Seller's ability to reasonably relocate manpower, and any materials and equipment during the period and the Purchaser shall pay said amount. If of any such delay, the time of performance shall be extended for a period equal to the time lost by reason of the delay.
- b) The Purchaser may cancel only upon written notice at least fifteen (15) days prior to the commencement of the training program and upon payment to the Seller of all accrued charges plus ten percent (10%) of the price for the terminated portion of the work, calculated as of the date of termination.

SC-T4. Warranties

- a) The Seller warrants to the Purchaser that the Training Services will be provided by a qualified instructor. Purchaser shall voice any objections to the instructor prior to the commencement of the training class. The Seller's obligation under this warranty shall expire with the completion of the Training Services.
- b) The foregoing sets forth the exclusive remedies of the Purchaser and the sole liability of the Seller for claims based on failure of, or defect in, the Training Services, whether a claim, however instituted, is based on contract, indemnity, warranty, tort (including negligence), strict liability or otherwise. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL. NO IMPLIED OR STATUTORY WARRANTIES, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.

SC-T5. Limitation of Liability

The total liability of the Seller, its employees, subcontractors or suppliers on all claims of any kind (excluding claims for death or bodily injury), whether based on contract, indemnity, warranty, tort (including negligence), strict liability or otherwise, resulting from the Training Services or any extension or expansion thereof (including remedial warranty efforts), shall in no case exceed the Training Price or U.S. \$10,000, whichever is greater. All such liability shall terminate upon the expiration of the warranty period set forth in these Special Conditions for Training Services.

SC-T6. Indemnification

- a) All Purchaser Personnel receiving training under this Contract shall be considered as employees or agents of the Purchaser and the Purchaser shall be responsible for payment all income, unemployment, social security and other payroll taxes, including contributions from them when required by law.
- b) The Purchaser agrees to indemnify and hold the Seller, the Seller's subcontractors and participating equipment Purchasers, harmless from any claims or demands (including the costs, expenses and reasonable attorney's fees on account thereof) that may be made: (i) by anyone for injuries or death to persons or damage to the Seller's or third party property, including theft, resulting from the Purchaser's acts or omissions or the acts or omissions of Purchaser Personnel; or (ii) under Workmen's Compensation or similar laws by the Purchaser or by Purchaser's Personnel.
- c) The Purchaser agrees to defend the Seller, the Seller's subcontractors and participating equipment Purchasers, at the Seller's request, against claims under or demands described in the foregoing paragraph against the Seller, the Seller's subcontractors and participating equipment Purchasers, for which the Purchaser or Purchaser's Personnel are responsible hereunder.
- d) The Purchaser agrees to indemnify the Seller, its employees, agents and subcontractors against any claims or demands (including costs, expenses, and attorney's fees) that may be asserted by any third party (including persons receiving training under this Contract) arising out of, or related to the Training Services furnished by the Seller hereunder except to the extent that any such claim or demand is the direct result of the affirmative negligence of the Seller, its employees, agents or subcontractors.
- e) In no event will the Seller be liable for the actions of the persons being trained taken on their own time outside of the time during which instruction is being given.
- f) This article will survive termination of the Contract.

Attachment 14 GE Parent Company Guarantee Template

GUARANTY AGREEMENT

This **GUARANTY AGREEMENT** (the "Guaranty") is made as of the [Day]th day of [Month], [Year], by **GENERAL ELECTRIC COMPANY**, a corporation duly organized and existing under the laws of the State of New York, U.S.A., with its head office situated at 3135 Easton Turnpike, Fairfield, Connecticut 06431, U.S.A., and a place of business at 1333 West Loop South, Houston, TX 77027 U.S.A. (herein called "Guarantor"), for the benefit of _____, a corporation duly organized and existing under the laws of Delaware, with its head office situated at _____

(herein called "Owner"). (Guarantor and Owner are individually referred to herein as a "Party" and collectively as the "Parties.")

RECITALS:

WHEREAS, GE Packaged Power, Inc., a corporation duly organized and existing under the laws of the State of Delaware, U.S.A., with its head office situated at 1333 West Loop South Houston, TX 77008 (herein called "Contractor") is a wholly owned affiliate of Guarantor;

WHEREAS, Owner has entered into an agreement with Contractor dated _____ (together with the schedules, annexes, and exhibits thereto and as the same may be amended from time to time, herein called the "Contract"), for the supply of _____ gas turbine generator to be located at the City of _____;

WHEREAS, Section 4.1 of the Contract requires Contractor to obtain and deliver a parent company guarantee of Contractor's performance under the Contract; and

WHEREAS, Guarantor, as ultimate parent company of Contractor, is willing to enter into this Guaranty to satisfy the conditions of the Contract.

NOW, THEREFORE, in consideration of the premises and mutual covenants set forth herein, the Parties hereto agree as follows:

1. Guarantor unconditionally and irrevocably guarantees to Owner that in the event of Contractor failing in any respect to perform or observe the terms and provisions of the Contract, Guarantor shall immediately upon first demand in writing by Owner perform or take such steps as are necessary to achieve performance or observance of such terms and provisions and shall indemnify and keep indemnified Owner against any and all losses, damages, claims, costs, charges, and expenses howsoever arising from the said failure to the extent of Contractor's liability under the Contract; provided, that Guarantor's maximum

Contract For U.S. Based Sale of Equipment and Services

aggregate liability under this Guaranty shall be an amount equal to ____ percent (0%) of the Contract Price, as such term is defined in the Contract.

2. The liability of Guarantor hereunder shall not be reduced or discharged by any alteration in the relationship between Contractor and Owner which has been consented to by Contractor in writing (with or without the knowledge or consent of Guarantor), or by any forbearance or indulgence by Owner towards Contractor or Guarantor whether as to payment, time, performance, or otherwise.

3. Guarantor agrees to make any payment due hereunder upon first written demand without set-off or counterclaim and without any legal formality such as protest or notice being necessary, and waives all privileges or rights which it may have as a guarantor, including any right to require Owner to claim payment or to exhaust remedies against Contractor or any other person.

4. The obligations of Guarantor hereunder shall continue in full force and effect until the successful performance testing of the Equipment at Owner's site.

5. This Guaranty and the undertakings herein contained shall be binding upon the successors and assigns of Guarantor and shall extend to and inure for the benefit of the successors or permitted assignees of Owner. Owner may assign, charge, or transfer all or any of its right, title and interest in this Guaranty upon such terms as Owner may think fit to any agent for and on behalf of any syndicate of banks and financial institutions providing credit and guaranty facilities to Owner in connection with the Contract. No person other than Owner or such permitted assignees as described above is intended as a beneficiary of this Guaranty nor shall any such person have any rights hereunder. Guarantor may not otherwise assign or otherwise transfer any of its rights or obligations hereunder.

6. Notwithstanding anything to the contrary above, in the event of any claim under this Guaranty, Guarantor shall be entitled to assert any defense, set-off or counterclaim that Contractor could assert had such claim been made directly against any person under the Contract.

7. In the event there is any dispute under the Contract that relates to a sum being claimed under this Guaranty, which dispute is submitted to arbitration, the obligations under this Guaranty shall be suspended pending the outcome of such arbitration and Guarantor further agrees that any award resulting from such arbitration shall be conclusive and binding on it for purposes of determining its obligation under this Guaranty.

8. This Guaranty shall be governed by and construed in accordance with the laws of the State of New York, provided that any provision of such law invalidating any provision of this Guaranty or modifying the intent of the Parties as expressed in the terms of this Guaranty shall not apply.

Contract For U.S. Based Sale of Equipment and Services

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed by their respective authorized representatives as of the date first written above.

(Purchaser Name)

GENERAL ELECTRIC COMPANY

By: _____

By: _____

Name: _____

Name: Charles Blankenship

Title: _____

Title: General Manager

Attachment 15 TYPICAL Spare Parts Lists

(See Attached)

1. 2-Year Operational Spare parts List.
 - i. The attached list is based on gas turbine generator package configuration with a Meidensha generator. List may vary, dependant upon actual slot configuration.
 - ii. The attached list is based on total of three (3) Units.
 - iii. BUDGETARY pricing shown. Final list/pricing to be provided during project execution phase.
2. Startup and Commissioning Spare Parts

LM 6000 PC CLASSIC 60HZ	
SUMMARY SHEET	
CMS 702846 Chula Vista	
BUDGETARY (RSPL) RECOMMENDED SPARE PARTS LIST	
3 x LM 6000 PC NDW ES Fuel Meidensha	
SECTION	EXTENDED PRICE
VENTILATION & COMBUSTION SYSTEM	\$ 6,073.25
TURBINE LUBE OIL SYSTEM	\$ 19,446.25
FUEL SYSTEM (NGW)	\$ 107,725.25
3500 SERIES VIBRATION SYSTEM	\$ 12,229.00
HYDRAULIC START SYSTEM	\$ 21,511.50
GENERATOR LUBE OIL SYSTEM	\$ 20,991.25
FIRE PROTECTION SYSTEM	\$ 15,295.50
INSTRUMENTATION AND AUXILIARY SYSTEM	\$ 9,860.25
SPRINT MAIN UNIT	\$ 5,401.00
SPRINT OFF BASE SKID	\$ 29,124.75
LEVEL ONE (1) TOOLING	\$ 50,955.00
LM6000PC 60HZ - MicroNet WITH LINKNET	\$ 68,159.00
HOSES	\$ 24,417.18
MEIDENSHA GENERATOR SPARES	\$ 204,240.00
CABLES	\$ 56,916.00
WATER WASH SYSTEM	\$ 8,168.75
TURBINE INSURANCE SPARES	\$ 542,508.75
TURBINE EXPENDABLES	\$ 17,904.55
GRAND TOTAL	\$ 1,220,927.23
BUDGETARY SPARE PARTS LIST SUBJECT TO CHANGE WHEN FINAL DRAWINGS ISSUED	
RSPL Creation August 24,2006	

VENTILATION & COMBUSTION SYSTEM					
571239 rev N					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
12	5VX1500	3	Belt, Turbine Exhaust Fan C29592 60hz 6 belts per fan	\$86.00	\$1,032.00
10	5VX1060	6	Belt, Generator Exhaust Fan C-31109 60hz 5 belts per fan	\$68.75	\$687.50
1	J01310	11	Sensor, Temperature	\$289.25	\$289.25
1	382A6511P0001	12	Gauge, Differential Pressure Filter System	\$571.00	\$571.00
1	1950-10	13&14	Switch, Differential Pressure-Filter System	\$210.50	\$210.50
1	382A5656P0001	15	Transmitter, Differential Pressure, Main and Generator Enclosure	\$1,920.00	\$1,920.00
1	382A6510P0001	36	Gauge, Differential Pressure Coils	\$571.00	\$571.00
1	J04182	50	Element, Temperature	\$441.00	\$441.00
1	J04194	51	Element, Temperature	\$351.00	\$351.00
				TOTAL	\$6,073.25

TURBINE LUBE OIL SYSTEM					
571244 rev J					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
6	HC9600FKN13Z	1	Element, Filter-Lube Oil	\$177.00	\$1,062.00
1	J00464	2	TLO Thermostatic Control Valve	\$1,421.00	\$1,421.00
1	J04920	3	Switch, Level-Lube Oil Tank	\$1,194.00	\$1,194.00
1	155-500710-606	7	TLO Tank Heater	\$615.00	\$615.00
1	132P41C6B	27	Switch, Pressure-Scavenge	\$360.25	\$360.25
1	160P4S36	28	Switch, Differential Pressure-Lube Oil Filters	\$798.00	\$798.00
1	J04467	29	Transmitter, Pressure Supply and Scavenge	\$1,245.00	\$1,245.00
1	J00092	45	Power Turbine Cooling Air Purge Solenoid	\$1,103.00	\$1,103.00
1	2028511	47	Replacement Element for TLO Air/Oil Separator	\$7,390.00	\$7,390.00
2	95-117	51	Element, Filter-Lube Oil Tank Demister 2 per unit	\$1,075.00	\$2,150.00
1	162P42C6BH	52	Switch, Differential Pressure-VG Pump Filter	\$1,313.00	\$1,313.00
1	152P82C6413	53	Switch, Differential Pressure-A/O Separator	\$795.00	\$795.00
				TOTAL	\$19,446.25

FUEL SYSTEM (GAS FUEL W/ WATER INJECTION)					
571260 rev R					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	382A5248P0001	3	Switch, Pressure Fuel Low	\$401.50	\$401.50
1	382A5249P0001	5	Switch, Pressure Fuel High	\$436.00	\$436.00
1	382A5658P0001	6	Transmitter, Pressure, Fuel Supply and Manifold	\$1,351.00	\$1,351.00
1	382A5489P0002	7	Valve, Solenoid-Combustor Drain	\$3,235.00	\$3,235.00
1	J01068	12	Sensor, Temperature-Fuel Gas & Water Injection	\$339.75	\$339.75
1	382A5506P0002	13	Valve, Solenoid Gas Vent	\$4,205.00	\$4,205.00
1	382A5322P0001	15	Valve, Gas	\$23,200.00	\$23,200.00
1	377A8054P0001	19	Valve, Gas Shut Off	\$11,160.00	\$11,160.00
1	382A5340P0001	21	Transmitter, Gas Fuel Flow	\$4,517.00	\$4,517.00
1	382A5505P0002	46	Valve, Solenoid Fuel Manifold Drain	\$2,014.00	\$2,014.00
1	382A5376P0001	47	Transmitter, Turbine Supply and Manifold Demin Water	\$1,772.00	\$1,772.00
1	382A5504P0002	48	Valve, Solenoid Demin Water	\$2,630.00	\$2,630.00
1	382A4821P0001	51	Valve, Water Injection Flow Control	\$45,084.00	\$45,084.00
1	382A5374P0002	53	Transmitter, Water Flow	\$4,828.00	\$4,828.00
1	382A5476P0002	55	Valve, Solenoid Demin Water	\$2,552.00	\$2,552.00
				TOTAL	\$107,725.25

3500 SERIES VIBRATION SYSTEM					
Standard 3500 Spares-P/N Subject to change on build Release					
QTY	PART NUMBER	DESCRIPTION		UNIT PRICE	EXTENDED PRICE
1	3500/15-04-00-01		DC Power Supply	\$1,062.00	\$1,062.00
1	3500/92-04-01-01		System Monitor	\$1,362.00	\$1,362.00
1	3500/44-02-01		AeroDerivative Monitor	\$2,856.00	\$2,856.00
1	3500/40-02-01		Proximitor Monitor	\$1,998.00	\$1,998.00
1	3500/42-02-01		Proximitor/Seismic Monitor	\$2,663.00	\$2,663.00
1	330180-50-05		Proximitor	\$318.00	\$318.00
1	330180-90-05		Proximitor	\$330.00	\$330.00
	86517-01-01-01-01		Accelerometer Interface Module	\$820.00	\$1,640.00
2					
				TOTAL	\$12,229.00

HYDRAULIC START SYSTEM					
571232 rev M					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
2	P16-5354	2	Element-Charge Pump	\$53.50	\$107.00
4	P16-5659	4&5	Element, Filter-Charge Pump	\$76.75	\$307.00
1	382A3860P0100	10	Starter Motor	\$3,333.00	\$3,333.00
1	382A3861P0100	10	Overrunning Clutch	\$7,254.00	\$7,254.00
1	J04683	11	Hydraulic Pump / SOV Actuated	\$5,119.00	\$5,119.00
1	100P44C6R	14	Switch, Hydraulic Pump Control	\$504.00	\$504.00
1	180P44C6R	15	Switch, Vacuum-Charge Pump	\$585.00	\$585.00
1	J04919	16	Switch, Level-Reservoir	\$671.00	\$671.00
1	132T4FC6	17	Switch, Case Temperature High	\$467.50	\$467.50
1	100TC5DC6R	18	Switch, Reservoir Temp Low	\$867.00	\$867.00
1	J00829	19	Reservoir Heater and Thermostat	\$701.00	\$701.00
1	L35166P02	26	Hydraulic Starter Clutch Temperature Element	\$1,596.00	\$1,596.00
				TOTAL	\$21,511.50

GENERATOR LUBE OIL SYSTEM					
571248 rev U					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
3	HC8904FKN13Z	1	Replacement Element - Generator Lube Oil Filter	\$182.00	\$546.00
1	J00176	2	GLO Thermostatic Control Valve	\$2,765.00	\$2,765.00
1	J04920	3	Switch, Level-Lube Oil Tank	\$1,194.00	\$1,194.00
1	155-500710-605	8	Heater, Generator Lube Oil Tank	\$638.00	\$638.00
1	655R-EDR-2INCH	25	GLO Pressure Control Valve	\$7,162.00	\$7,162.00
1	160P4S36	28	Switch, Differential Pressure GLO	\$798.00	\$798.00
1	132P4S129	29	Switch, Pressure GLO	\$324.25	\$324.25
1	100TC5DCC6R15	30	Switch, Temperature Low GLO	\$725.00	\$725.00
1	S313240102	31	GLO Bearing Metal Temperature Element	\$629.00	\$629.00
1	J01068	32	Sensor, Temperature-Lube Oil Supply	\$339.75	\$339.75
1	J04467	33	Transmitter, Pressure-Lube Oil	\$1,245.00	\$1,245.00
1	LV471-03-05-SG1	49	Switch, Rundown Tank Level	\$540.00	\$540.00
12	P16-7185	66	Element, Filter- HP Jacking Oil Pump Discharge	\$301.75	\$3,621.00
1	132P4S185	68	GLO Pressure Switch	\$464.25	\$464.25
				TOTAL	\$20,991.25

FIRE PROTECTION SYSTEM					
571254 rev E					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	382A4669P0001	1	Detector, Optical Flame	\$4,169.00	\$4,169.00
1	240835EXPB	4	Detector, Thermal Spot, 450 Deg F	\$290.50	\$290.50
1	240833EXPB	5	Detector, Thermal Spot, 225 Deg F	\$271.00	\$271.00
2	141A8869P0001	9	Detector, Combustible Gas	\$2,463.00	\$4,926.00
1	897494	12	Valve, Solenoid Main Release Auto/Manual	\$1,172.00	\$1,172.00
1	382A4652P0001	27	Detector, IR Gas	\$4,467.00	\$4,467.00
				TOTAL	\$15,295.50

INSTRUMENTATION AND AUXILIARY SYSTEM					
571272 rev G					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	382A5355P0001	4	Transmitter, Pressure HP Discharge PS3	\$1,211.00	\$1,211.00
1	382A5599P0001	8&9	Generator Proximeter DE and NDE	\$818.00	\$818.00
1	382A1079P0001	18	Transmitter, Pressure HP Inlet P25	\$1,341.00	\$1,341.00
1	382A1357P0001	19	Transmitter, Pressure LP Turbine Inlet P48	\$2,183.00	\$2,183.00
1	J03490	25	Transmitter, Pressure Inlet Static PO	\$1,835.00	\$1,835.00
1	382A1358P0001	28	Transmitter, Pressure Thrust Balance PTB1	\$2,183.00	\$2,183.00
1	J01310	33	Temperature Sensor Assembly	\$289.25	\$289.25
				TOTAL	\$9,860.25
SPRINT SYSTEM MAIN UNIT					
571268 rev L					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	1053V3	3	Instrument Valve (Used in multiple systems)	\$172.00	\$172.00
1	J04467	22	Transmitter, Pressure	\$1,245.00	\$1,245.00
12	289195	28	Hose Assembly 23 per unit	\$165.25	\$1,983.00
12	289196	29	Hose Assembly 23 per unit	\$166.75	\$2,001.00
				TOTAL	\$5,401.00
SPRINT SYSTEM OFF BASE SKID					
571270 rev L					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	132P49C6B	4	Pump Discharge Pressure Switch Low	\$304.50	\$304.50
1	382A5646P0001	5	Valve, Solenoid 24VDC 3/4" Instrument Air	\$1,286.00	\$1,286.00
1	3SVD-10STG	7	SPRINT Pump and Motor	\$8,557.00	\$8,557.00
1	386A7270P0001	10	Flow Meter, 4-20ma output 1"-150# RF	\$4,828.00	\$4,828.00
1	160P4S36	12	Differential Pressure Transmitter SPRINT Filter	\$798.00	\$798.00
3	382A1203P0001	13	Replacement Element for Sprint Filter	\$802.00	\$2,406.00
4	J00458	14	Check Valve, 1"FNPT 1/2" PSID Cracking (7per Unit)	\$209.00	\$836.00
1	J03679	15	Air Pressure Regulator	\$201.25	\$201.25
1	382A5485P0001	16	Flow Control Valve SPRINT Water	\$4,878.00	\$4,878.00
1	382A6399P0001	21	SOV Demin Water 1" FSAE 24VDC	\$2,505.00	\$2,505.00
1	382A6400P0001	22	SOV Demin Water Drain 1" FNPT 24VDC	\$2,525.00	\$2,525.00
				TOTAL	\$29,124.75

			LEVEL ONE (1) TOOLING		
			Minimum Required for BSI and Basic Level 1 Maintenance		
QTY	PART NUMBER		DESCRIPTION	UNIT PRICE	EXTENDED PRICE
0	1C3569G3		Hydraulic Actuator Unit	\$10,245.00	\$ -
0	1C6361G01		Tool Set - Radial Drive Shaft	\$4,509.00	\$ -
0	1C8182G01		Fixture Set - Removal, Mating Seal	\$5,775.00	\$ -
1	1C8208G02		Drive Adapter, Borescope Motoring Fixture	\$1,995.00	\$ 1,995.00
0	1C9353G02		Tool Set Rigging, VBV Doors	\$1,275.00	\$ -
0	1C9359G02		Rigging Set VIGV	\$885.00	\$ -
0	1C9393G01		Adapter Set, Pressure Test / Rigging VIGV, VBV, VSV System	\$900.00	\$ -
	1C9428G01		Adapter, Torque Breaking Compressor Stator Vane Actuating Arm Retaining Nut	\$1,935.00	\$ -
0					
0	2C6352G07		Wrench Set, Spanner - Air Tube Nuts	\$5,835.00	\$ -
0	2C6613G01		Gauge, Immersion Depth - Igniter	\$1,725.00	\$ -
0	2C6647G01		Wrench, Spanner - Compressor Stator Vane Spacer	\$960.00	\$ -
0	2C6925G03		Gage Set, VSV Clevis	\$4,410.00	\$ -
0	2C8102G02		Fixture, Torque Measuring - VSV Assembly	\$5,820.00	\$ -
1	9448M18G01		Hand Tool Kit (Snap-On)	\$6,600.00	\$ 6,600.00
	RC2000-LM		FutureDrive Turning Tool - Borescope Inspection	\$32,250.00	\$ -
0	1C9381G01		Fixture Assembly. Shipping Bracket Steam/Fuel Manifold	\$10,350.00	\$ -
0	1C9400G01		Fixture Set, Raise & Hinge - Upper Compressor Case	\$13,860.00	\$ -
0	1C9408G01		Fixture Set, Torque Measuring - Compressor VSV	\$6,885.00	\$ -
0	2C14699G02		Fixture, Lift - Compressor Stator Case, Upper	\$8,130.00	\$ -
0	2C6018G01		Tool Set, Holding - Variable Stator Vane	\$2,175.00	\$ -
1	216A3340P0001		VIDEOSCOPE, STANDARD	\$41,700.00	\$ 41,700.00
1	216A3927P0001		Safety Cable Tool, 7"	\$660.00	\$ 660.00
				TOTAL	\$ 50,955.00

			LM6000PC 60HZ - MicroNet WITH LINKNET		
			Typical-Part #'s subject to change when build released		
QTY	PART NUMBER		DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	1784-1028		ISOLATED LINEARIZED THERMOCOUPLE INPUT	\$413.00	\$413.00
1	1784-655		100 OHM RTD TO 0-5 VOLT	\$330.00	\$330.00
1	1784-659		NON-ISOLATED PASS THROUGH WITH 200 OHM RESISTER	\$122.00	\$122.00
1	382A4866P0001		INTERFACE, FOR RS-232 TO RS-422 AND RS-485, 2 CHANNELS	\$432.00	\$432.00
1	216A3726P0001		NETCON LOW DENSITY ANALOG BLACK 6FT	\$608.00	\$608.00
1	5417-042		CABLE - NETCON 14FT DISCRETE GRAY	\$608.00	\$608.00
	216A3727P0001		CABLE,RS232,SUB-D 9 PIN FEMALE SCREWLOCK TO SUB-D 9 PIN FEMALE	\$290.00	\$290.00
1					
1	5417-175		CABLE - MICRONET HIGH DENSITY	\$726.00	\$726.00
1	216A3728P0001		CABLE - RS-232, SUB-D 9-PIN MA	\$324.00	\$324.00
1	216A3729P0001		CABLE - MOLDED DB9F TO DB9F NULL	\$26.00	\$26.00
1	5437-523		MODULE - ANALOG FIELD TERM (STD)	\$528.00	\$528.00
1	5437-672		MODULE - NETCON FIELD TERMINAL	\$582.00	\$582.00
1	5437-845		BOARD - NOTCH FILTER 3KHZ	\$575.00	\$575.00
1	141A7026P0001		MODULE - 16 CHANNEL RELAY FTM	\$4,172.00	\$4,172.00
1	5441-693		HD DISCRETE I/O FTM (24 IN/12 OUT)	\$3,008.00	\$3,008.00
1	5441-695		MODULE - SIMPLEX FTM	\$2,406.00	\$2,406.00
1	5453-278		CHASSIS - MICRONET 12 SLOT	\$2,995.00	\$2,995.00
1	5453-754		BOX - MICRONET ETHERNET INTERFACE	\$582.00	\$582.00
1	5464-654		MODULE - 64 CH DISCRETE OUT	\$3,439.00	\$3,439.00
1	5464-658		MODULE - DIGITAL SPEED SENSOR	\$5,479.00	\$5,479.00
1	5466-031		MODULE - NETCON I/O CONTROLLER	\$3,858.00	\$3,858.00
1	5466-258		MODULE - SIMPLEX DISCRETE I/O	\$3,364.00	\$3,364.00
1	5466-348		MODULE - NETCON 5000B SIO	\$4,472.00	\$4,472.00
1	5466-409		MODULE - MICRONET PENTIUM CPU,	\$12,305.00	\$12,305.00
1	5466-425		HIGH DENSITY ANALOG I/O (TMR)	\$3,936.00	\$3,936.00
1	5501-432		MODULE - 2CH ACTUATOR CONTROLLER	\$4,963.00	\$4,963.00
1	5501-465		MODULE - MICRONET SIMPLEX POWER	\$4,178.00	\$4,178.00
1	9905-760		MODULE - ASSY OF LINKNET TERMINATION	\$196.00	\$196.00
1	9905-968		MODULE - LINKNET 6C 4-20 MA IN	\$1,098.00	\$1,098.00
1	9905-969		MODULE - LINKNET 6C 4-20MA IN	\$1,098.00	\$1,098.00
1	9905-971		MODULE - LINKNET DISCRETE IN	\$1,046.00	\$1,046.00
				TOTAL	\$ 68,159.00

HOSES					
Typical-Part #'s subject to change when build released					
QTY	PART NUMBER	QPE	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
2	398000	8	HOSE, INTERCONNECT AUXILIARY/MAIN, RH	\$243.75	\$487.50
1	398001	4	HOSE, INTERCONNECT/T HEAT EX, RIGHT HAND	\$339.00	\$339.00
1	398002	6	HOSE ASSY,1 X 37 OAL, RH	\$133.50	\$133.50
1	398003	1	HOSE, INTERFACE MANIFOLD	\$262.25	\$262.25
1	398004	1	HOSE, INTERFACE MANIFOLD	\$143.50	\$143.50
1	398005	1	HOSE, INTERCONNECT 78	\$317.25	\$317.25
1	398006	1	HOSE, INTERFACE MANIFOLD	\$693.00	\$693.00
1	398007	4	HOSE, INTERCONNECT AUX/MAIN, LH	\$287.25	\$287.25
1	398008	2	HOSE, INTERCONNECT S/T HEAT EX,LH	\$412.50	\$412.50
1	398010	3	HOSE ASSY,1 X 42 CTE,LH	\$207.00	\$207.00
4	398012	4	HOSE ASSY,1/4 X 10 OAL*	\$100.25	\$401.00
4	398013	7	HOSE, INSTRUMENT	\$140.25	\$561.00
1	398015	1	HOSE ASSY,1 X 14 OAL	\$235.00	\$235.00
1	398018	1	HOSE, ENGINE CONNECTION A10	\$1,152.00	\$1,152.00
1	398019	1	HOSE, ENGINE CONNECTION L6	\$533.00	\$533.00
1	398020	1	HOSE, ENGINE CONNECTION L1	\$760.00	\$760.00
1	398021	1	HOSE, ENGINE CONNECTION L2	\$735.00	\$735.00
1	398022	1	HOSE, ENGINE CONNECTION L3	\$534.00	\$534.00
1	398024	1	HOSE, EXHAUST COLLECTOR DRAIN	\$198.75	\$198.75
1	398025	1	HOSE, ENG CONNECTION A23, A24, A25, A28	\$81.75	\$81.75
4	398026	7	HOSE, INSTRUMENT	\$150.25	\$601.00
1	398027	1	HOSE ASSEMBLY, HYDRAULIC STARTER RETURN	\$189.00	\$189.00
1	398028	1	HOSE ASSEMBLY, HYDRAULIC STARTER SUPPLY	\$407.50	\$407.50
2	398029	2	HOSE, ENG CONNECTION OIL DRAINS	\$170.25	\$340.50
1	398038	4	HOSE, SUCTION JACKING OIL PUMP	\$110.25	\$110.25
1	398039	4	HOSE, DISCHARGE JACKING PUMP BR/MEID	\$98.00	\$98.00
1	398045	1	HOSE, MANIFOLD DRAIN TO FILTER	\$226.00	\$226.00
1	398046	1	HOSE, PUMP RELIEF TO TANK	\$131.00	\$131.00
1	398049	1	HOSE, FAN MOTOR DISCHARGE	\$113.50	\$113.50
1	398050	1	HOSE, RETURN FILTER OUTLET	\$245.50	\$245.50
1	398057	1	HOSE, FILTER RETURN TO COOLER	\$181.43	\$181.43
1	398058	1	HOSE, FAN PUMP RELIEF TO TANK	\$78.50	\$78.50
1	398070	1	HOSE, COOLER BYPASS TO TANK	\$120.25	\$120.25
1	398071	1	HOSE, PUMP DRAIN TO FILTER	\$151.50	\$151.50
1	398086	1	HOSE, MANIFOLD TO RETURN FILTER	\$446.00	\$446.00
1	398095	1	HOSE, PUMP SUCTION	\$177.00	\$177.00
1	398113	1	HOSE, AUX FAN PUMP TO MOTOR	\$75.25	\$75.25
1	398114	1	HOSE, COOLER TO TANK	\$162.75	\$162.75
1	398131	1	HOSE, FAN MOTOR SUCTION	\$93.50	\$93.50
1	398134	1	HOSE, MANIFOLD TO PUMP DISCHARGE	\$802.00	\$802.00
1	398209	1	HOSE, 3" AIR/OIL SEP, ROOF	\$810.00	\$810.00
1	398210	1	HOSE,2"-150# AIR/OIL SEP,ROOF	\$501.00	\$501.00
1	546622	1	HOSE ASSEMBLY	\$2,200.00	\$2,200.00
1	702015	1	HOSE, ENGINE CONNECTION D5	\$162.00	\$162.00
1	702051	1	HOSE ASSY, COMBUSTOR DRAIN	\$375.75	\$375.75
1	702087	1	HOSE ASSY,4" X 29 5/16"OAL	\$551.00	\$551.00
1	714509	1	HOSE ASSY,GLO,2"	\$442.50	\$442.50
1	714510	1	HOSE ASSY, DISCHARGE, MAIN GLO PUMP	\$342.25	\$342.25
1	714592	1	HOSE ASSY, GLO RETURN,4"	\$888.00	\$888.00
1	723239	1	HOSE,CONNECTION,ENGINE,A9	\$2,159.00	\$2,159.00
1	723971	1	HOSE DETAILS, AGB VENT	\$1,463.00	\$1,463.00
1	723972	1	HOSE ASSEMBLY, 1 1/2" A9/AGB HOSE ENGINE CONNECTION A9	\$1,298.00	\$1,298.00
				TOTAL	\$ 24,417.18

Meidensha 800LL04 RSPL					
Serial Numbers TBD					
QTY	PART NUMBER	QPE	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	216A5159P0001	1	BEARING SHELL (FOR D. E.)	\$43,000.00	\$43,000.00
1	216A5160P0001	1	BEARING SHELL (FOR N. D. E.)	\$30,000.00	\$30,000.00
3	386A6813P0001	3	DIODE RECTIFIER - 800LL04	\$1,450.00	\$4,350.00
3	386A6814P0001	3	DIODE RECTIFIER - 800LL04	\$1,450.00	\$4,350.00
6	AXR405110	6	C-R ABSORBER	\$135.00	\$810.00
12	XRDM410600	6	FUSE FOR DIODES	\$700.00	\$8,400.00
6	PC1-20A	3	FUSE FOR PMG	\$55.00	\$330.00
1	382A5353P0001	1	ROTOR EARTH FAULT DETECTOR	\$12,650.00	\$12,650.00
1	382A5354P0001	1	EARTH FAULT DISCRIMINATION UNIT	\$1,000.00	\$1,000.00
5	ADR430768B-1	1	SHAFT EARTHING BRUSH	\$200.00	\$1,000.00
1	386A6815P0001	4	SPACE HEATER FOR GENERATOR	\$1,350.00	\$1,350.00
1	386A6816P0001	1	SPACE HEATER FOR EXCITER	\$500.00	\$500.00
1	386A6817P0001	5	DUPLEX TYPE RTD FOR COOLING AIR	\$720.00	\$720.00
1	386A6818P0001	2	DUPLEX TYPE RTD FOR THRUST - RENK Bearing	\$1,000.00	\$1,000.00
1	386A6819P0001	2	DUPLEX TYPE RTD FOR JOURNAL - RENK Bearing	\$700.00	\$700.00
1	386A6820P0001	2	DUPLEX TYPE RTD FOR DRAIN OIL	\$1,150.00	\$1,150.00
1	XRZ410770	1	DISCHARGE RESISTOR	\$880.00	\$880.00
1	141A7033P0001	1	OIL PUMP FOR CW	\$25,050.00	\$25,050.00
0	141A8889P0001	1	COUPLING	\$8,800.00	\$0.00
0	386A6824P0001	1	EXTENSION SHAFT	\$350.00	\$0.00
2	XRCV410004-1	1	BEARING & SEAL FOR OIL PUMP	\$1,550.00	\$3,100.00
2	XRCV410004-2	1	MECHANICAL SEAL FOR OIL PUMP	\$3,850.00	\$7,700.00
2	141A7032P0001	2	JACKING HOSE FOR RENK JOURNAL BEARING	\$1,200.00	\$2,400.00
1	141A7035P0001	1	JACKING HOSE FOR RENK OUTER THRUST BEARING	\$2,200.00	\$2,200.00
1	141A7034P0001	1	JACKING HOSE FOR RENK INNER THRUST BEARING	\$2,200.00	\$2,200.00
48	216A3461P0001	24	AIR FILTER	\$400.00	\$19,200.00
1	XRZM411850	2	DIFFERENTIAL PRESSURE TRANSMITTER	\$8,200.00	\$8,200.00
1	RCL310476	1	LABYRINTH SEAL FOR D.E OUTSIDE	\$5,500.00	\$5,500.00
1	RCL310404B	1	LABYRINTH SEAL FOR N.D.E OUTSIDE	\$5,500.00	\$5,500.00
1	RCL310405B	1	LABYRINTH SEAL FOR D.E INSIDE	\$5,500.00	\$5,500.00
1	RCL310405B	1	LABYRINTH SEAL FOR N.D.E INSIDE	\$5,500.00	\$5,500.00
				TOTAL	\$204,240.00

CABLES					
Typical-Part #'s subject to change when build released					
QTY	PART NUMBER	QPE	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
1	129525-0005-02	4	CABLE, PROX I/O MOD-EXT TB,5FT	\$129.75	\$129.75
1	129530-0005-02	1	CABLE, KPH I/O MOD-EXT TB,5FT	\$89.25	\$89.25
1	608214-4036	2	CABLE,ENG,LM6000,E1 OR E9,40FT	\$2,022.00	\$2,022.00
1	608919-4036	1	CABLE,ENGINE,LM6000,E21,40FT	\$1,795.00	\$1,795.00
1	608920-4036	1	CABLE,ENGINE,LM6000,E16,40FT	\$1,815.00	\$1,815.00
1	608926-4036	1	CABLE,ENGINE,LM6000,E8,40FT	\$2,037.00	\$2,037.00
1	608927-4036	1	CABLE,ENGINE,LM6000,E7,40FT	\$2,037.00	\$2,037.00
1	608928-4036	1	CABLE,ENGINE,LM6000,E5,40FT	\$1,904.00	\$1,904.00
1	608930-4036	1	CABLE,ENGINE,LM6000,E12,40FT	\$1,353.00	\$1,353.00
1	608932-4036	1	CABLE,ENGINE,LM6000,E19,40FT	\$2,471.00	\$2,471.00
1	608933-4036	1	CABLE,ENGINE,LM6000,E20,40FT	\$2,271.00	\$2,271.00
1	608934-4036	2	CABLE,ENG,LM6000,E10,E11,40FT	\$2,037.00	\$2,037.00
1	608935-3036	2	CABLE,ENG,LM6000,E30,E31,30FT	\$994.00	\$994.00
1	249A4751P0001	1	CABLE,ENGINE,LM6000,E34,30FT	\$3,791.00	\$3,791.00
1	249A4747P0001	1	CABLE,ENGINE,LM6000,E36,30FT	\$2,021.00	\$2,021.00
1	609975-40	1	CABLE,ENGINE,LM6000,E22,40FT	\$1,750.00	\$1,750.00
1	609976-40	1	CABLE,ENGINE,LM6000,E32,40FT	\$1,904.00	\$1,904.00
1	8EH15AAA1	1	CABLE,PATCH,12-13",AMETEK,E12	\$1,027.00	\$1,027.00
1	8EH2ABW1	1	CABLE, BAL PISTON VLV,E56,40FT	\$2,822.00	\$2,822.00
1	8EH2AEG1	1	CABLE,ENGINE,LM2500,+,DLE,40FT	\$994.00	\$994.00
1	8EH2DHA1	1	CABLE,ENGINE,AMETEK,LM6000,E40	\$5,352.00	\$5,352.00
1	8EH2DHB1	1	CABLE,ENGINE,AMETEK,LM6000,E41	\$5,939.00	\$5,939.00
1	8EH2DHC1	1	CABLE,ENGINE,AMETEK,LM6000,E48	\$2,611.00	\$2,611.00
1	8EH2DHD1	1	CABLE,ENGINE,AMETEK,LM6000,E49	\$4,084.00	\$4,084.00
1	8EH2DHF1	2	CABLE,ENG,AMETEK,LM6000,E54/55	\$1,578.00	\$1,578.00
1	8EH2DHR1	2	CABLE,ENGINE,AMETEK,E57A/57B	\$2,088.00	\$2,088.00
				TOTAL	\$56,916.00

WATER WASH SYSTEM					
571262 rev L					
QTY	PART NUMBER	ITEM # ON DRAWING	DESCRIPTION	UNIT PRICE	EXTENDED PRICE
2	J-4413	N/A	Contect 6000, 55 Gallon Drum Turbine Wash	\$1,249.00	\$2,498.00
1	382A4846P0001	3	Switch, Low Level Indicator	\$1,420.00	\$1,420.00
1	382A6340P0001	9	Valve, Solenoid	\$1,527.00	\$1,527.00
3	386A3188P0001	10	Filter Element Kit Offline and Online	\$74.25	\$222.75
1	382A5510P0002	12	Heater Element and Thermostat	\$1,236.00	\$1,236.00
1	800H-BP7A	19	Hand Switch Water Wash	\$162.00	\$162.00
1	J00091	22	Purge Air SOV	\$1,103.00	\$1,103.00
				TOTAL	\$8,168.75

GE Proprietary Information

ITEM	PART NUMBER	NOMENCLATURE	REC		2007 UNIT PRICE	2007 EXTENDED PRICE CM
			QPE	QTY 4		
1	1304M52G03	HPT STAGE 2 BORESCOPE	1	2	663.00	1326.00 *
2	1322M32G10	LPT STAGE 2/4 BORESCOPE	2	2	943.00	1886.00
3	1642M98G01	CHECK VALVE	4	1	10,750.00	10750.00 *
4	1962M86P02	T48 THERMOCOUPLE	8	5	6,799.00	33995.00
5	1826M46G01	CHECK VALVE & TUBE	4	1	5,636.00	5636.00 *
6	38-18604-2024-3	SCREEN	3	1	1,661.00	1661.00
7	38-18604-2025-3	SCREEN	3	1	1,661.00	1661.00
8	38-18604-2026-3	SCREEN, LUBE INLET	1	1	1,854.00	1854.00
9	4J7316	CHIP DETECTOR	3	2	3,091.00	6182.00
10	9299M96G07	HPT STAGE 1 BORESCOPE	2	2	1,240.00	2480.00 *
11	9392M95P04	PLUG, IGNITER	2	2	1,150.00	2300.00
12	9600M37P13	LEAD, IGNITER	2	1	2,614.00	2614.00
13	L21131P02	XN25 SENSOR, SPEED	2	2	1,107.00	2214.00
14	L24922P03	PUMP, VG HYDRAULIC	1	1	37,990.00	37990.00
15	L31967P27	ACCELEROMETER, CRF	1	1	10,110.00	10110.00
16	L31967P29	ACCELEROMETER, TRF	1	1	8,620.00	8620.00
17	L35166P01	DETECTOR, RESISTANCE TEMP	7	3	1,596.00	4788.00
18	L43416P02	T3 SENSOR	1	1	9,435.00	9435.00
19	L43418P03	VSV/ VIGV ACTUATOR	4	1	15,590.00	15590.00
20	L43419P04	VBV ACTUATOR	2	1	17,640.00	17640.00
21	L43420P04	VBV ACTUATOR	4	1	7,617.00	7617.00
22	L44500P09	PUMP, L&S	1	1	48,350.00	48350.00
23	L44571P01	HYDRAULIC CONTROL	1	1	120,000.00	120000.00
24	L44684P01	LPT SPEED SENSOR	2	1	6,241.00	6241.00
25	L44736P05	UPPER T48 HARNESS	1	1	8,210.00	8210.00
26	L44737P04	LOWER T48 HARNESS	1	1	8,644.00	8644.00
27	L44745P01	T2/P2 SENSOR (CIT)	1	1	10,150.00	10150.00
28	L44745P02	T25/P25 SENSOR	1	1	10,150.00	10150.00
GAS FUEL WITH WATER INJECTION						
29	9504M33P01	SENSOR, TEMP	2	1	7,480.00	7480.00
30	L31476P57	FUEL NOZZLE	30	6	9,609.00	57654.00
31	L45921P01	GASKET	2	3	381.00	1143.00
32	L45972G01	FUEL TUBE	30	2	1,648.00	3296.00
33	L49273P03	FUEL HOSE	30	6	1,420.00	8520.00
34	L49274P03	SEC-FUEL HOSE	2	1	2,554.00	2554.00
SPRINT KIT (682L903GXX)						
35	L38060P13	NOZZLE, WATER	12	2	9,967.00	19934.00
36	L38060P15	NOZZLE, INLET	23	2	9,967.00	19934.00
37	L38060P16	NOZZLE, WATER	12	2	9,967.00	19934.00
38	L52030G01	TUBE, WATER	24	1	321.50	321.50
39	L52031G01	TUBE, AIR	9	1	540.00	540.00
40	L52032G01	TUBE, AIR	15	1	456.25	456.25
41	L52615G01	ADAPTER, STG 8	1	1	2,487.00	2487.00
42	L52619P03	ORIFICE, PLATE	1	1	161.00	161.00
					TOTAL	\$542,508.75
NOTES: LIST WILL SUPPORT 1-3 ENGINES. QPE=QUANTITY PER ENGINE QTY=QUANTITY RECOMMENDED PRICES ON THIS LIST ARE SUBJECT TO CHANGE ON 10/31/2007. **** EXTREME CARE MUST BE TAKEN TO ASSURE DIFFERENT CONFIGURATION FUEL NOZZLES ARE NOT INADVERTENTLY MIXED. ENGINE DAMAGE CAN OCCUR. REFERENCE LM6000 ILLUSTRATED PASTS BREAKDOWN GEK 105060 **** Updated Oct 9,2007 for MMC Chula Vista						

GE Proprietary Information							
ITEM	PART NO.	NOMENCLATURE	QPE	REC 1-3	2007 UNIT PRICE	EXTENDED PRICE	CM
1	1337M46P03	GASKET, PLUG - IGNITER	1	2	7.25	14.50	*
2	1538M42P01	GASKET, P49	1	2	11.50	23.00	*
3	1540M69P207	CLAMP, LOOP - CUSHION	9	4	16.50	66.00	*
4	1774M59P01	SEAL, RING	12	5	25.25	126.25	*
5	1855M35P08	BOLT, MACHINE, DBL HEX HD, SELF-LOCKING, 0.250-28 BY 0.375 LG	305	10	25.75	257.50	
6	619E223P52	FITTING, REDUCER, 0.5625-18 THD AND 0.4375-20 THD	1	1	36.50	36.50	*
7	635E901P03	NUT, SPLINE DRIVE SELF-LOCKING	2	10	9.50	95.00	*
8	705B276P5	RING, RETAINING	2	4	4.40	17.60	*
9	9009M32P01	WASHER, KEY	51	10	2.05	20.50	*
10	9009M74P03	GASKET, ROUND	1	4	11.00	44.00	
11	9011M60P01	GASKET, FUEL FILTER	2	3	60.50	181.50	*
12	9013M28P01	GASKET, SEAL	1	2	72.00	144.00	*
13	9013M29P02	GASKET, LUBE IN SEAL	1	3	186.50	559.50	
14	9013M30P02	GASKET, LUBE IN SEAL	1	3	155.75	467.25	
15	9048M33P06	BEARING, PLAIN	12	2	126.00	252.00	*
16	9057M50P01	SEAL	1	1	63.00	63.00	*
17	9057M92P10	GASKET, SQUARE	1	1	3.45	3.45	*
18	9108M27P03	BOLT, EXTERNAL-REL, 0.375-24 BY 1.230 LG	18	5	77.50	387.50	
19	9109M91P01	BOLT, MACHINE, HEX HD, 0.250-28 BY 1.68 LG	6	5	4.70	23.50	
20	9131M44P02	BUSHING, SLEEVE	18	5	61.75	308.75	
21	9365M41P117	SEAL, O-RING, 0.739 ID	14	5	5.25	26.25	*
22	9365M41P122	SEAL, O-RING, 1.051 ID	14	5	7.25	36.25	*
23	9365M41P229	SEAL, O-RING, 3.100 ID	1	3	24.50	73.50	*
24	9371M19P04	SEAL-BOSS & FITTING	2	3	60.00	180.00	*
25	9371M19P06	SEAL	2	2	61.00	122.00	*
26	9371M19P08	SEAL-BOSS AND FITTING	2	1	54.50	54.50	*
27	9371M19P10	SEAL	10	2	33.25	66.50	
28	9371M19P12	SEAL	8	3	45.25	135.75	
29	9378M31P01	FITTING, REDUCER	20	3	54.50	163.50	*
30	9379M93P01	GASKET	8	5	17.00	85.00	*
31	9397M20P02	IGNITER BUSHING, MACHINE THREAD	2	1	534.00	534.00	*
32	9397M22P02	WASHER, LOCK	2	1	52.25	52.25	*
33	9559M20G01	RING ASSY, SEAL	30	30	97.25	2917.50	*
34	9601M73P07	SEAL, FLANGED OIL	1	1	1,026.00	1026.00	*
35	9608M12P04	GASKET, ROUND	3	10	3.45	34.50	*
36	9609M13P02	GUIDE, ACTUATOR LEVER	2	5	44.25	221.25	*
37	9609M43P02	WASHER, FLAT	2	10	0.53	5.30	*
38	9610M50P02	NUT, SELF-LOCKING, DBL HEX, 0.250-28	6	10	5.25	52.50	*
39	9628M16P02	BOLT, SHEAR, HEX HD, 0.3125-24 BY 1.850 LG	2	3	6.50	19.50	*
40	9629M48P02	NUT, SELF-LOCKING, HEX, AMS 5735, 0.190-32	4	10	4.40	44.00	
41	9629M48P04	NUT, SELF-LOCKING, HEX, AMS 5735, 0.250-28	4	10	4.40	44.00	*
42	9629M48P06	NUT, SELF-LOCKING, HEX, AMS 5735, 0.375-24	32	10	5.75	57.50	*
43	9629M48P10	NUT, SELF-LOCKING, HEX, AMS 5735, 0.3125-24	16	10	7.00	70.00	
44	9634M85P01	RING, SEAL MATING	1	1	260.00	260.00	*
45	9649M39P04	CLAMP, COUPLING	1	1	442.75	442.75	*
46	9699M66P01	BOLT, MACHINE, SQUARE HD, 0.190-32 BY 0.560 LG	51	10	8.50	85.00	*
47	AC-B244F-2440Y	Element, Filter (5 inches Lg)	1	2	539.00	1078.00	
48	AN316C4R	NUT, JAM, HEX 0.250-28	154	10	1.05	10.50	
49	AN960C10	WASHER, FLAT	8	10	0.09	0.90	*
50	AN960C10L	WASHER, FLAT	8	10	0.05	0.50	*
51	AN960C416L	WASHER, FLAT	34	10	0.09	0.90	*
52	AN960C516	WASHER, FLAT	32	10	0.26	2.60	*
53	AN960C516L	WASHER, FLAT	20	10	0.05	0.50	*
54	AN960C616L	WASHER, FLAT	8	10	0.05	0.50	*
55	J1092P04	NUT, SELF-LOCKING, TEN POINT, 0.250-28	475	25	6.25	156.25	*
56	J1092P05	NUT, SELF-LOCKING, TEN POINT, 0.3125-24	200	10	2.00	20.00	*
57	J1220G05	CLAMP, LOOP, CUSHIONED, 0.312 INCH TUBE DIA	13	5	2.95	14.75	*
58	J1221G03	CLAMP, LOOP, CUSHIONED, 0.188 INCH TUBE DIA	28	4	4.50	18.00	*
59	J1221G04	CLAMP, LOOP, CUSHIONED, 0.250 INCH TUBE DIA	4	4	4.20	16.80	*
60	J1221G07	CLAMP, LOOP, CUSHIONED, 0.438 INCH TUBE DIA	16	3	10.50	31.50	*
61	J1221G08	CLAMP, LOOP, CUSHIONED, 0.500 INCH TUBE DIA	15	10	8.50	85.00	*
62	J1221G10	CLAMP, LOOP, CUSHIONED, 0.625 INCH TUBE DIA	24	5	7.25	36.25	*
63	J201P04	NUT, SELF-LOCKING, DBL HEX, THIN, 0.375-24	2	5	13.25	66.25	*
64	J219P02	GASKET, SEAL	2	3	18.75	56.25	*
65	J219P03	GASKET, SEAL	2	2	13.75	27.50	*
66	J219P04	GASKET, SEAL - FLANGE, FUEL & OIL	6	5	20.25	101.25	*
67	J219P05	GASKET, SEAL	8	5	25.50	127.50	*
68	J219P06	GASKET, SEAL-FLANGE, FUEL AND OIL	1	4	11.00	44.00	*
69	J219P07	GASKET, SEAL	1	4	14.75	59.00	*
70	J221P028	PACKING, PREFORMED 1.358 ID	1	5	1.30	6.50	*

GE Proprietary Information							
ITEM	PART NO.	NOMENCLATURE	QPE	REC 1-3	2007 UNIT PRICE	EXTENDED PRICE	CM
71	J221P138	PACKING, PREFORMED, 2.102 ID	1	5	1.90	9.50	*
72	J221P163	PACKING, PREFORMED, 5.964 ID	1	2	12.00	24.00	*
73	J221P216	PACKING, PREFORMED, 1.103 ID	1	5	1.40	7.00	*
74	J221P224	PACKING, PREFORMED, 1.724 ID	2	2	9.00	18.00	*
75	J221P240	PACKING, PREFORMED, 3.719 ID	1	2	5.50	11.00	*
76	J221P260	PACKING, PREFORMED, 6.461 ID	1	2	12.25	24.50	*
77	J221P903	PACKING, PREFORMED, 0.296 ID	4	3	0.49	1.47	*
78	J221P904	PACKING, PREFORMED, 0.346 ID	36	10	0.49	4.90	*
79	J221P905	PACKING, PREFORMED, 0.409 ID	5	10	2.30	23.00	*
80	J221P906	PACKING, PREFORMED, 0.463 ID	2	10	0.49	4.90	*
81	J221P908	PACKING, PREFORMED, 0.639 ID	5	10	1.20	12.00	*
82	J221P910	PACKING, PREFORMED, 0.750 ID	3	10	0.74	7.40	*
83	J221P912	PACKING, PREFORMED, 0.915 ID	4	10	0.86	8.60	*
84	J221P916	PACKING, PREFORMED, 1.165 ID	1	5	0.74	3.70	*
85	J414P034A	BOLT, SHEAR, DBL HEX HD, 0.250-28 BY 1.270 LG	18	10	4.30	43.00	*
86	J415P123A	BOLT, SHEAR, DBL HEX HD, 0.3125-24 BY 1.125 LG	6	3	7.00	21.00	*
87	J511P106	NIPPLE, TUBE	2	2	18.75	37.50	*
88	J511P108	NIPPLE, TUBE	1	1	25.50	25.50	*
89	J511P110	NIPPLE, TUBE	4	1	31.00	31.00	*
90	J534P06	NIPPLE, TUBE	2	1	38.00	38.00	*
91	J534P10	NIPPLE, TUBE	3	1	73.25	73.25	*
92	J534P12	NIPPLE, TUBE-BOSS CONNECTION, 321/347 CRES	3	1	71.25	71.25	*
93	J574P02	NUT, SELF-LOCKING, 0.250-28	154	10	6.25	62.50	*
94	J628P06	NUT, SELF-LOCKING, TEN POINT, 0.375-24	2	2	5.25	10.50	*
95	J643P04B	BOLT, MACHINE, DBL HEX HD, 0.190-32 BY 0.438 LG	4	4	5.25	21.00	*
96	J644P06D	BOLT, MACHINE, DBL HEX HD, 0.250-28 BY 0.562 LG	4	10	7.00	70.00	*
97	J644P07D	BOLT, MACHINE, DBL HEX HD, 0.250-28 BY 0.625 LG	16	10	5.50	55.00	*
98	J644P08D	BOLT, MACHINE, DBL HEX HD, 0.250-28 BY 0.688 LG	90	10	9.00	90.00	*
99	J644P09D	BOLT, MACHINE, DBL HEX HD, 0.250-28 BY 0.750 LG	2	5	9.00	45.00	*
100	J644P11A	BOLT, MACHINE-INCONEL ALLOY 718 DOUBLE HEXAGON HEAD	84	10	3.90	39.00	*
101	J644P12A	BOLT, MACHINE, DBL HEX HD, 0.250-28 BY 0.938 LG	63	10	3.90	39.00	*
102	J645P30A	BOLT, MACHINE, DBL HEX HD, 0.3125-24 BY 2.375 LG	32	5	18.00	90.00	*
103	J816P072C	BOLT, SHEAR-DBL HEX HD, 0.375-24 BY 1.219 LG	2	1	86.00	86.00	*
104	L28004P01	GASKET, SEAL	1	2	720.00	1440.00	*
105	L34976P069	BOLT, SELF-LOCKING, 0.375-16 BY 2.750 LG	8	3	71.00	213.00	*
106	L43073P01	GASKET, THERMAL ISOLATOR	2	2	28.75	57.50	*

**TYPICAL LM6000
START-UP AND COMMISSIONING SPARES**

QTY	PART NUMBER	DESCRIPTION
4	SVX1000	BELT, GENERATOR, SUPPLY FAN
6	SVX1250	BELT, TURBINE, EXHAUST FAN
4	HC9600FKN13Z	FILTER ELEMENT, TURBINE
1	CONNTECT 5000	WATERWASH (55 GAL DRUM)
2	HC9600FKS8Z	FILTER ELEMENT, HP HYDRAULIC
5	AL1335	50MA FUSES
5	AL1328	2 AMP FUSES
5	AL1310	0.1 AMP FUSE
5	AL1269	4 AMP FUSE
5	AL1308	31 MA FUSE
5	P13-2582	3 AMP FUSE
5	P13-5712	1/4 AMP FUSE
1	226166-001	CALIBRATION, GAS CYLINDER
5	CGI-3L	GASKET,FLG.4"-300#
5	CGI-3P	GASKET,FLG.6"-300#
5	CGI-3Q	GASKET,FLG.8"-300#
5	CGI-6D	GASKET,FLG.1"-600#
5	CGI-6G	GASKET,FLG.2"-600#
5	CGI-6J	GASKET,FLG.3"-600#
5	CGI-6L	GASKET,FLG.4"-600#
2	HC9600FKD13Z	FUEL FILTER (LIQUID)
1	ACB2442440Y1	FILTER ELEMENT,TURBINE HYD
2	P16-5659	FILTER ELEMENT,HYD START
1	HUOO157956	FILTER ELEMENT, CHARGE PUMP

Attachment 16 GE Specifications

(See Attached)

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GE Energy

Process Specification Fuel Gases For Combustion In AeroDerivative Gas Turbines

These instructions do not purport to cover all details or variations in equipment or to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes the matter should be referred to the GE Company.

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1 GENERAL

GE AeroDerivative gas turbines have the ability to burn a wide range of gaseous fuels as shown in Table 1. These gases present a broad spectrum of properties due to both active and inert components. This specification is designed to define guidelines that must be followed in order to burn these fuels in an efficient, trouble-free manner, while protecting the gas turbine and supporting hardware.

Table 2 identifies the acceptable test methods to be used in determining gas fuel properties.

TABLE 1 FUEL GAS USABILITY						
Fuel Type	LHV Btu/SCF (kJ/NM³)	Wobbe Number	Major Components	Operational Comments	Applicability SAC DLE	
Pipeline Natural Gas	850-1200 (33383-47128)	45-60	Methane	No Restrictions	Yes	Yes
Medium BTU Natural Gas	400 - 850 (15709-33838)	20-45	Methane, Hydrocarbons (HC), carbon dioxide, Nitrogen	Requires > 700 BTU/scf (27492 kJ/NM ³) for starting. May require modified fuel nozzles. Contact GE	Yes	No, See Note 8.
Liquefied Petroleum Gas (LPG)	2300-3200 (90330-125676)	70-75	Propane, Butane	May require specific fuel nozzles. Contact GE	Yes	No
Gasification Gases - Air Blown	150-200 (5891-7855)	6-8	Carbon monoxide, Hydrogen, HC, Nitrogen, Water Vapor	Contact GE	Yes	No
- Oxygen Blown	200- 400 (7855-15709)	8-20	Carbon monoxide, Hydrogen, HC, Water Vapor	Contact GE	Yes	No
Process Gases	300-1000 (11782-39274)	15-50	Methane, Hydrogen, Carbon monoxide, Carbon dioxide	Requires >700 BTU/scf (27492 kJ/NM ³) for starting. Restricted transient operation.	Yes	See Note 8
Refinery Gases	1000-1300 (39274-51056)	45-60	Methane, Hydrogen, Carbon monoxide, Ethylene, Propylene, Butylene	No restrictions. Hydrogen content should be reviewed by GE.	Yes	See Note 8

Notes:

- When considering the use of alternate fuels, provide details of the fuel constituents, fuel temperature, and expected engine usage conditions and operating characteristics to GE for evaluation and recommendations.
- Values and limits apply at the inlet of the gas fuel control module.

3. Heating value ranges shown are provided as guidelines. Specific fuel analysis must be furnished to GE for evaluation. The standard configured single annular combustor (SAC) gas turbines require a fuel with a LHV no less than of 6500 BTU/pound. The Dry Low Emissions (DLE) combustion system requires a minimum LHV of 18000 BTU/pound. (Reference Section 3.1)
4. The quantity of sulfur in gas fuels is not limited by this specification. Experience has shown that oxidation/corrosion rates are not significantly affected by fuel sulfur levels up to 1.3% sulfur. Hot corrosion of hot gas path parts is affected by the presence of the specified trace metals. Sulfur levels shall be considered when addressing HRSG Corrosion, selective catalytic reduction (SCR) deposition, exhaust emissions, system material requirements, elemental sulfur deposition and iron sulfide. (Reference Section 4.3)
5. The fuel gas supply shall be 100% free of liquids. Admission of liquids can result in combustion and/or hot gas path component damage. (Reference Section 3.3)
6. Wobbe Number, or Modified Wobbe Number Index, is described in 3.2.
7. Gases with Wobbe Number Index greater than 40 may be applicable for DLE. Contact GE.
8. Process and refinery gases with <5% hydrogen content and low CO and CO₂ content may be acceptable for DLE application. Contact GE.

NM³ is at 0°C, 101.325kPa (sea level)

TABLE 2
TEST METHODS FOR GASEOUS FUELS

PROPERTY	ASTM METHOD
Gas Composition to C6+	D1945 - Standard method for constituents of gases by gas chromatography
Heating Value	D3588 - Procedure for calculating calorific value and specific gravity of gaseous fuels
Specific Gravity	D3588 - Procedure for calculating calorific value and specific gravity of gaseous fuels
Compressibility Factor	D3588 - Procedure for calculating calorific value and specific gravity of gaseous fuels
Dew Point (see note 1)	D1142 - Water vapor content of gaseous fuels by measurement of dew point temperature
Sulfur	D1072 - Test for total sulfur in fuel gases (see note 2) D3246 - Test for total sulfur in fuel gases
Chemical Composition	D2650 - Standard method for chemical composition of gases by mass spectrography

Notes:

1. Hydrocarbon and water dew points shall be determined by direct dew point measurement (Chilled Mirror Device). If dew point cannot be measured, an extended gas analysis, which identifies hydrocarbon components from C1 through C14, shall be performed. This analysis must provide an accuracy of greater

than 10 ppmv. A standard gas analysis to C6+ is normally not acceptable for dew point calculation unless it is known that heavier hydrocarbons are not present, as is most often the case with liquefied natural gases.

2. This test method will *not* detect the presence of condensable sulfur vapor. Specialized filtration equipment is required to measure sulfur at concentrations present in vapor form. Contact GE for more information.

2 FUEL GAS CLASSIFICATION

2.1 Natural and Liquefied Petroleum Gas (LPG)

Natural gases are predominantly methane with much smaller quantities of the slightly heavier hydrocarbons such as ethane, propane and butane. Liquefied petroleum gas is propane and/or butane with traces of heavier hydrocarbons.

2.1.1 Pipeline Natural Gas

Natural gases normally fall within the calorific heating value range of 850 to 1200 Btu/SCF (33383-47128 kJ/NM³) (LHV). Actual calorific heating values are dependent on the percentages of hydrocarbons and inert gases contained in the gas.

2.1.2 Medium BTU Natural Gas

Natural gases are found in and extracted from underground reservoirs. These “raw gases” may contain varying degrees of nitrogen, carbon dioxide, hydrogen sulfide, and contain contaminants such as salt water, sand and dirt. Processing by the gas supplier normally reduces and/or removes these constituents and contaminants prior to use in the gas turbine. A gas analysis must be performed to ensure that the fuel supply to the gas turbine meets the requirements of this specification.

2.1.3 Liquefied Petroleum Gases

The heating values of Liquefied Petroleum Gases (LPGs) normally fall between 2300 and 3200 Btu/SCF (90330-125676 kJ/NM³) (LHV). Based on their high commercial value, these fuels are normally utilized as a back-up fuel to the primary gas fuel for gas turbines. Since LPGs are normally stored in a liquid state, it is critical that the vaporization process and gas supply system maintains the fuel at a temperature above the minimum required superheat value. Fuel heating and heat tracing is required to ensure this.

2.2 Gasification Fuels

Other gases that may be utilized as gas turbine fuel are those formed by the gasification of coal, petroleum coke or heavy liquids. In general, the heating values of gasification fuel are substantially lower than other fuel gases. These lower heating value fuels require that the fuel nozzle gas flow passages be larger than those utilized for fuels of higher heating values.

Gasification fuels are produced by either an Oxygen Blown or Air Blown gasification process.

2.2.1 Oxygen Blown Gasification

The heating values of gases produced by oxygen blown gasification fall in the range of 200 to 400 Btu/SCF (7855-15709 kJ/NM³). The Hydrogen (H₂) content of these fuels is normally above 30% by volume and have H₂/CO mole ratio between 0.5 to 0.8. Oxygen blown gasification fuels are often mixed with steam for thermal NO_x control, cycle efficiency improvement and/or power augmentation. When utilized, the steam is injected into the combustor by an independent passage. The current guideline for Hydrogen plus CO constituent is limited to 75% by volume for LM6000 and to 85% for the other AeroDerivative gas turbines. Due to high hydrogen content of these fuels, oxygen blown gasification fuels are normally not suitable for Dry Low Emissions (DLE) applications, for which the Hydrogen content is limited to 5% by volume.. The high flame speeds resulting from high hydrogen fuels can result in flashback or primary zone re-ignition on DLE pre-mixed combustion systems. Utilization of these fuels shall be reviewed by GE.

2.2.2 Air Blown Gasification

Gases produced by air blown gasification normally have heating values between 150 and 200 BTU/ SCF (5891-7855 kJ/NM³) LHV. The Hydrogen (H₂) content of these fuels can range from 8% to 20% by volume and have a H₂/CO mole ratio 0.3 to 3:1. The use and treatment of these fuels are similar to that identified for oxygen blown gasification.

For Gasification fuels a significant part of the total turbine flow comes from the fuel. In addition, for oxygen blown fuels there is a diluent addition for NO_x control. Careful integration of the gas turbine with the gasification plant is required to assure an operable system. Due to the low volumetric heating value of both oxygen and air blown gases, special fuel system and fuel nozzles are required.

2.3 Process Gases

Many chemical processes generate surplus gases that may be utilized as fuel for gas turbines. (i.e. tail or refinery gases). These gases often consist of methane, hydrogen, carbon monoxide, and carbon dioxide that are normally byproducts of petrochemical processes. Due to the hydrogen and carbon monoxide content, these fuels have large rich to lean flammability limits. These types of fuels often require inerting and purging of the gas turbine gas fuel system upon unit shutdown or a transfer to a more conventional fuel. When process gas fuels have extreme flammability limits such that the fuel will auto ignite at turbine exhaust conditions, a more “conventional” start-up fuel, such as methane, is required.

Additional process gases utilized as gas turbine fuels are those which are byproducts of steel production. These are:

2.3.1 Blast Furnace Gases (BFGs)

Blast Furnace Gases (BFGs), alone, have heating values below minimal allowable limits. These gases must be blended with other fuel to raise the heating value to above the required limit. Coke Oven and/or Natural Gases or hydrocarbons such as propane or butane can be utilized to accomplish this.

2.3.2 Coke Oven Gases

Coke oven gases are high in H₂ and H₄C and may be used as fuel for single annular combustion (SAC) systems, but are not suitable for Dry Low Emissions (DLE) combustion applications. These fuels often contain trace amounts of heavy hydrocarbons, which when burned could lead to carbon buildup on the fuel nozzles. The heavy hydrocarbons must be “scrubbed” or removed from the fuel prior to delivery to the gas turbine.

2.3.3 COREX Gases

COREX gases are similar to oxygen blown gasified fuels, and may be treated as such. They are usually lower in H₂ content and have lower heating values than oxygen blown gasified fuels. Further combustion related guidelines could be found in Bureau of Mines Circulars 503 and 622.

2.3.4 Hydrogen

The presence of gaseous hydrogen in the fuel can present special problems due to the high flame speed and high temperatures associated with combustion, and the very wide flammability limits of this gas. Treatment of fuels containing hydrogen are separated into three categories, less than 5% by volume, 6% to 30% by volume and over 30%. If the hydrogen fuel content is 5% or less, no special precautions are necessary and starting on this fuel mixture can be permissible, assuming there are no other restrictive substances in the mix.

For fuels containing more than 5%, but 30% or less hydrogen, an alternative starting fuel may be required by local safety codes and a special exhaust system purge cycle is incorporated into the gas turbine start sequence to eliminate accumulated fuels from an aborted start. In addition, special high point venting is required for both the fuel gas and turbine compartments since the fuel constituents are normally lighter than air. The vents hold the compartment at a slight vacuum relative to local ambient. Special precautions must also be taken to completely seal the fuel delivery system from leaks. Consult the local authorities for specific local safety codes.

If the fuel contains more than 30% hydrogen, electrical devices used in the fuel gas and turbine compartments should be certified for use in Group B (explosive) atmospheres. Consult the local authorities for specific local safety codes.

2.4 Refinery Gases

Many hydrocarbon fuels contain olefin hydrocarbon compounds which have been thought to prohibit their use in aeroderivative gas turbines.

Fuel temperature is also a consideration in order to use standard fuel nozzles and to avoid the possibilities of fuel polymerization. Maximum fuel temperature of 125°F (52°C) is recommended. It may be possible to go as high as 190°F (88°C), but this may require non-standard fuel nozzle sizing and should be considered on a case by case basis. Please contact GE for assistance.

Because refinery gas fuels usually have significant higher hydrocarbon and olefin content the combustor flame temperatures are typically higher, resulting in higher than normal (high methane gas) NOx emissions. Contact GE for effect on emissions.

3 FUEL PROPERTIES

3.1 Heating Value

A fuel's heat of combustion, or heating value, is the amount of energy, expressed in Btu (British thermal unit), generated by the complete combustion, or oxidation, of a unit weight of fuel. The amount of heat generated by complete combustion is a constant for a given combination of combustible elements and compounds.

For most gaseous fuels, the heating value is determined by using a constant pressure, continuous type calorimeter. This is the industry standard. In these units, combustible substances are burned with oxygen under essentially constant pressure conditions. In all fuels that contain hydrogen, water vapor is a product of combustion, which impacts the heating value. In a bomb calorimeter, the products of combustion are cooled to the initial temperature and all of the water vapor formed during combustion is condensed. The result is the HHV, or higher heating value, which includes the heat of vaporization of water. The LHV, or lower heating value, assumes all products of combustion including water remain in the gaseous state, and the water heat of vaporization is not available.

3.2 Modified Wobbe Index Range

While gas turbines can operate with gases having a very wide range of heating values, the amount of variation that a single specific fuel system can accommodate is much less. Variation in heating value as it affects gas turbine operation is expressed in a term identified as modified Wobbe Index (Natural Gas, E. N. Tiratsoo, Scientific Press Ltd., Beaconsfield, England, 1972). This term is a measurement of volumetric energy and is calculated using the Lower Heating Value (LHV) of the fuel, specific gravity of the fuel with respect to air at ISO conditions, and the fuel temperature, as delivered to the gas turbine. The mathematical definition is as follows:

$$\text{Modified Wobbe Index} = LHV / (SG_{\text{gas}} \times T)^{1/2}$$

This is equivalent to:

$$\text{Modified Wobbe Index} = LHV / [(MW_{\text{gas}} / 28.96) \times T]^{1/2}$$

Where:

- LHV = Lower Heating Value of the Gas Fuel (Btu/scf)
- SG_{gas} = Specific Gravity of the Gas Fuel relative to Air
- MW_{gas} = Molecular Weight of the Gas Fuel
- T = Absolute Temperature of the Gas Fuel (Rankine)
- 28.96 = Molecular Weight of Dry Air

The allowable modified Wobbe Index range is established to ensure that required fuel nozzle pressure ratios be maintained during all combustion/turbine modes of operation. When multiple gas fuels are supplied and/or if variable fuel temperatures result in a Modified Wobbe Index that exceed the $\pm 10\%$ limitation, independent fuel gas trains, which could include control valves, manifolds and fuel nozzles, may be required for standard combustion systems. For DLE applications the Wobbe Index range must be between 40 and 60. An accurate analysis of all gas fuels, along with fuel gas temperature profiles shall be submitted to GE for proper evaluation.

3.3 Superheat Requirement

The superheat requirement is established to ensure that the fuel gas supplied to the gas turbine is 100% free of liquids. Dependent on its constituents, gas entrained liquids could cause degradation of gas fuel nozzles, and for DLE applications, premixed flame flashbacks or re-ignitions. A minimum of 50°F (28°C) of superheat is required and is specified to provide enough margin to compensate for temperature reduction due to pressure drop across the gas fuel control valves.

3.4 Flammability Ratio

Fuel gases containing hydrogen and/or carbon monoxide will have a ratio of rich to lean flammability limits that is significantly larger than that of natural gas. Typically, gases with greater than 5% hydrogen by volume fall into this range and require a separate startup fuel. Consult the local authorities for specific local safety codes.

Fuel gases with large percentage of an inert gas such as nitrogen or carbon dioxide will have a ratio of rich-to-lean flammability limits less than that of pure natural gas. Flammability ratios of less than 2.2 to 1 as based on volume at ISO conditions (14.696 psia and 59°F (101.325 kPa and 15°C)), may experience problems maintaining stable combustion over the full operating range of the turbine.

3.5 Gas Constituent Limits

Gas constituents are not specifically limited except to the extent described in Fuel Gas Classification. These limitations are set forth to assure stable combustion through all gas turbine loads and modes of operation. Limitations are more stringent for DLE combustion systems where “premixed” combustion is utilized. A detailed gas analysis shall be furnished to GE for proper evaluation.

3.6 Gas Fuel Supply Pressure

Gas fuel supply pressure requirements are dependent on the gas turbine model and combustion design, the fuel gas analysis and unit specific site conditions. Minimum and maximum supply pressure requirements can be determined by GE for specific applications.

4 CONTAMINANTS

Dependent on the type of fuel gas, the geographical location and the forwarding means there is the potential for the “raw” gas supply to contain one or more of the following contaminants:

1. Tar, lamp black, coke
2. Water, salt water
3. Sand, clay
4. Rust
5. Iron sulfide
6. Scrubber oil or liquid
7. Compressor Lube oil
8. Naphthalene
9. Gas Hydrates

It is critical that the fuel gas is properly conditioned prior to being utilized as gas turbine fuel. This conditioning can be performed by a variety of methods. These include but are not limited to media filtration, inertial separation,

coalescing and fuel heating. Trace metal, particulate and liquid contamination limits are given below. These limits are given in parts per million by weight (ppmw) corrected to the actual heating value of the fuel. It is critical that fuel gas conditioning equipment be designed and sized so that these limits are not exceeded.

4.1 Particulate

Contamination limits for particulates are established to prevent fouling and excessive erosion of hot gas path parts, erosion and plugging of combustion fuel nozzles and erosion of the gas fuel system control valves. The utilization of gas filtration or inertial separation is required. The filtration level should be a beta ratio of 200 minimum (efficiency of 99.5%) at 5μ or less. The total particulate should not exceed 30 ppm by weight. GE requires the use of stainless steel piping downstream of this last level of filtration.

4.2 Liquids

No liquids are allowed in the gas turbine fuel gas supply. Liquids contained in the fuel can result in nuisance and/or hardware damaging conditions. These include rapid excursions in firing temperature and gas turbine load, primary zone re-ignition and flashback of premixed flames, and when liquids carry over past the combustion system, melting of hot gas path components. When liquids are identified in the gas supply, separation and heating is employed to achieve the required superheat level.

4.3 Sulfur

There is no specific limit on natural gas fuel sulfur content if the engine is used in an application where both the fuel and environment are free of alkali metals. There are several concerns relative to the levels of sulfur contained in the fuel gas supply. Many of these are not directly related to the gas turbine but to associated equipment and emissions requirements. These concerns include but are not limited to:

4.3.1 Hot Gas Path Corrosion

Typically, use of sulfur bearing fuels will not be limited by concerns for corrosion in the turbine hot gas path unless alkali metals are present. Sodium, potassium and other alkali metals are not normally found in natural gas fuels, but are typically found to be introduced in the compressor inlet air in marine environments, as well as in certain adverse industrial environments. The total amount of sulfur and alkali metals from all sources shall be limited to form the equivalent of 0.6 ppm of alkali metal sulfates in the fuel. Unless sulfur levels are extremely low, alkali levels are usually limiting in determining hot corrosion of hot gas path materials. For low Btu gases, the fuel contribution of alkali metals at the turbine inlet is increased over that for natural gas and the alkali limit in the fuel is therefore decreased. The total amount of alkali metals ^(a) in gas fuels used with engines having marinized (corrosion-resistant) coatings on the high pressure turbine blading shall not exceed 0.2 ppm ^(b).

- (a) Sodium, potassium, and lithium. Experience has shown that sodium is by far the preponderant alkali metal, if any, found in gaseous fuels.
- (b) This limit assumes zero alkali metals in the inlet air or injected water or steam. When actual levels are above zero, the maximum allowable sodium content of the fuel must be reduced in accordance with the following relationship:

$$\begin{array}{rcl}
 \text{ppm sodium inlet air} \times \text{Air/Fuel Ratio} & = & \\
 \text{ppm sodium in water or steam} \times & & \\
 \quad \frac{\text{Water or Steam}}{\text{Fuel}} \text{ ratio} & = & \\
 \text{ppm sodium in fuel} & = & \\
 \text{Total fuel equivalence for sodium from all} & \text{_____} & \\
 \text{sources not to exceed} & 0.2 \text{ ppm} &
 \end{array}$$

4.3.2 HRSG Corrosion

If heat recovery equipment is used, the concentration of sulfur in the fuel gas must be known so that the appropriate design for the equipment can be specified. Severe corrosion from condensed sulfuric acid results if a heat recovery steam generator (HRSG) has metal temperatures below the sulfuric acid dew point. Contact the HRSG supplier for additional information.

4.3.3 Selective Catalytic Reduction (SCR) Deposition

Units utilizing ammonia injection downstream of the gas turbine for NO_x control can experience the formation of deposits containing ammonium sulfate and bisulfate on low temperature evaporator and economizer tubes. Such deposits are quite acidic and therefore corrosive. These deposits, and the corrosion that they cause, may also decrease HRSG performance and increase backpressure on the gas turbine. Deposition rates of ammonium sulfate and bisulfate are determined by the sulfur content of the fuel, ammonia content in the exhaust gas, tube temperature and boiler design. Fuels having sulfur levels above those used as odorants for natural gas should be reported to GE. In addition, the presence of minute quantities of chlorides in the inlet air may result in cracking of AISI 300 series stainless steels in the hot gas path. Contact the SCR supplier for additional information.

4.3.4 Exhaust Emissions

Sulfur burns mostly to sulfur dioxide, but 5% to 10% oxidizes to sulfur trioxide. The latter can result in sulfate formation, and may be counted as particulate matter in some jurisdictions. The remainder will be discharged as sulfur dioxide. To limit the discharge of acid gas, some localities may restrict the allowable concentration of sulfur in the fuel.

4.3.5 Elemental Sulfur Deposition

Solid elemental sulfur deposits can occur in gas fuel systems downstream of pressure reducing stations or gas control valves under certain conditions. These conditions may be present if the gas fuel contains elemental sulfur vapor, even when the concentration of the vapor is a few parts per billion by weight. Concentrations of this magnitude cannot be measured by commercially available instrumentation and deposition cannot therefore be anticipated based on a standard gas analysis. Should deposition take place, fuel heating will be required to maintain the sulfur in vapor phase and avoid deposition. A gas temperature of 130°F (54°C) or higher may be required at the inlet to the gas control valves to avoid deposition, depending on the sulfur vapor concentration. The sulfur vapor concentration can be measured by specialized filtering equipment. If required, GE can provide further information on this subject.

APPENDIX 1 – DEFINITIONS***Dew Point***

This is the temperature at which the first liquid droplet will form as the gas temperature is reduced. Common liquids found in gas fuel are hydrocarbons, water and glycol. Each has a separate and measurable dew point. The dew point varies considerably with pressure and both temperature and pressure must be stated to properly define the gas property. Typically, the hydrocarbon dew point will peak in the 300 to 600 psia (2068 to 4137 kPa) range.

Dry Saturated Conditions

The gas temperature is at, but not below or above, the dew point temperature. No free liquids are present

Gas Hydrates

Gas hydrates are semi-solid materials that can cause deposits that plug instrumentation lines, control valves and filters. They are formed when free water combines with one or more of the C1 through C4 hydrocarbons. Typically the formation will take place downstream of a pressure reducing station where the temperature drop is sufficient to cause moisture condensation in a region of high turbulence. Because hydrates can cause major problems in the gas distribution network, the moisture content is usually controlled upstream at a dehydration process station.

Gas Hydrate Formation Line

This is similar to the dew point line except the temperature variation with pressure is much less. The hydrate line is always below or at the moisture dew point line as free water must exist in order for hydrates to form. Maintaining 50°F of superheat above the moisture dew point will eliminate hydrate formation problems.

Glycol

Glycol is not a natural constituent of natural gas but is introduced during the dehydration process. Various forms of glycol are used, diethylene and triethylene glycol being two most common. In some cases glycol is injected into the pipeline as a preservative. In most cases, glycol may only be a problem during commissioning of a new pipeline or if an upset has taken place at an upstream dehydration station.

Superheat

This is defined as the difference between the gas temperature minus the liquid dew point. The difference is always positive or zero. A negative value implies that the value is being measured at two differing states of pressure and temperature and is not valid. A measured gas temperature below the theoretical dew point means that the gas is in a wet saturated state with free liquids present.

Saturation Line

This is the same as the dew point line.

Wet Saturated Conditions

A point where a mixture consists of both vapor and liquids.

Requirements for Water and Steam Purity for Injection in Aero Derivative Gas Turbines

1.1 Scope

This document establishes the purity requirements for water for NOx suppression and SPRINT[®] injection into gas turbine engines and for Steam for injected into the gas turbine whether for NOx suppression or power augmentation.

1.2 Definitions

For the purpose of this specification, the following definitions shall apply:

NOx Suppression Water - Water introduced into the engine combustor for the purpose of suppressing the oxides of nitrogen (NOx) in the engine exhaust gases.

SPRINT[®] Water – Water introduced into the engine inlet or into the high pressure compressor inlet for purpose of power enhancement.

2. Applicable Documents

2.1 American Society of Testing and Materials Publications.

ASTM D512 Standard Test Method for Chloride Ion in Water

ASTM D516 Standard Test Method for Sulfate Ion in Water

ASTM D859 Standard Test Method for Silica in Water

ASTM D1066 Standard Practice for Sampling Steam

ASTM D1125 Standard Test Method for Electrical Conductivity and Resistivity of Water

ASTM D3370 Standard Practices for Sampling Water from closed Conduits

ASTM D4191 Standard Test Method for Sodium in Water by Atomic Absorbtion
Spectography

ASTM D4192 Standard Test Method for Potassium in Water by Atomic Absorbtion
Spectography

ASTM D5907 Standard Test Method for Filterable and Non-Filterable Matter in Water

ASTM D5464 Standard Test Method for pH of Water with Low Conductivity

2.2 Environmental Protection Agency (EPA) Test Methods

EPA 160.3	Residue, Non-Filterable and Total Suspended Solids
EPA 150.1	pH Electrometric
EPA 120.1	Conductance, Specific Conductance at 25°C
EPA 200.7	Metals & Trace Elements
EPA 325.3	Chloride, Titrimetric Mercuric Nitrate
EPA 375.4	Sulfate, Turbidimetric

3. Water Requirements

3.1 Water Sampling Requirements

The sampling shall be in accordance with ASTM D3370. A minimum of one (1) gallon or four (4) liters shall be supplied.

3.2 Water Purity Requirements

The water shall meet the following requirements when tested in accordance with the designated test method:

	Limit	Test Method
Total Suspended Solids and Total Dissolved Solids, mg/L, max	5	ASTM D5907 or EPA 160.3
pH	6.0 - 8.0	ASTM D5464 or EPA 150.1
Conductivity, $\mu\text{S}/\text{cm}$ at 25°C	< 1.0	ASTM D1125 or EPA 120.1
Sodium + potassium, ppm, max	See 3.3	ASTM D4191 and D4192 or EPA 200.7
Silica (SiO_2), mg/L, max.	0.1	ASTM D859 or EPA 200.7
Chlorides, mg/L, max	0.5	ASTM D512 or EPA 325.3
Sulfates, mg/L, max	0.5	ASTM D516 or EPA 375.4

3.3 Sodium & Potassium Limits in Water or Steam

The maximum amount of Na + K allowed in the water or steam injected into the engine depends upon the total Na + K contamination from all sources; i.e., from the fuel, air, water and steam. The maximum Na + K allowed is determined from the equation:

$$(\text{ppmFuel}) + (\text{ppmAir}) * A/F + (\text{ppmWater}) * W/F + (\text{ppmSteam}) * S/F = 0.2 \text{ ppm}$$

Where:

ppmFuel	=	Parts per million Na + K in fuel
ppmAir	=	Parts per million Na + K in Air
ppmWater	=	Parts per million Na + K in water
ppmSteam	=	Parts per million Na + K in steam
A/F	=	Air/Fuel Ratio (Wt. Basis)
W/F	=	Water/Fuel Ratio (Wt. Basis)
S/F	=	Steam/Fuel Ratio (Wt. Basis)

3.4 Water Filtration Requirements

The water shall contain no particles larger than 20 microns absolute.

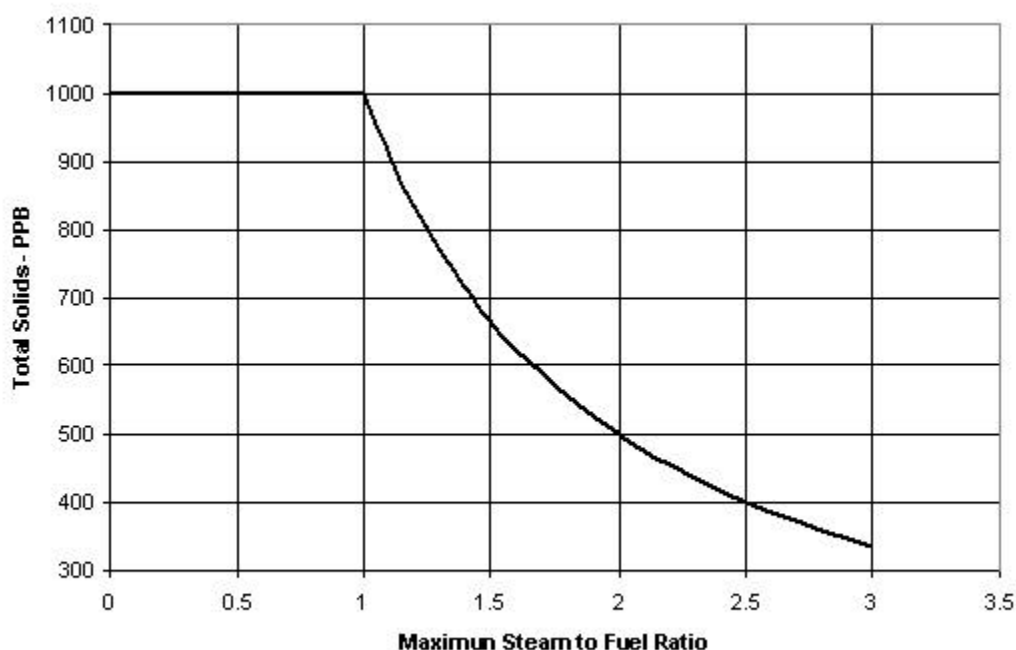
4.0 Steam Requirements

4.1 Steam Purity

The Steam shall meet the following requirements when tested in accordance with the designated test method:

- Sodium + Potassium (Na +K) – See paragraph 3.3
- Total Conductivity (Cation + Anion)
Normal: <1.5 $\mu\text{S}/\text{cm}$ (95% of operation time)
Abnormal: < 2.0 $\mu\text{S}/\text{cm}$ (5% of operating time)
- Total Solids

The maximum total solids depends on the steam/fuel weight ratios at which the gas turbine is to operate in the specific application. The value is determined from the following figure. Contaminant size shall not exceed 250 microns. With the exception of silica, there is no differentiation between types of solids as long as other limitations of this section are met. Silica in the steam is limited to 20 ppb.



4.2 Steam Sampling

Steam samples should be taken in accordance with ASTM D1066.

Compressor Cleaning Water Purity

Specification for GE Aircraft Derivative Gas Turbines in Industrial Applications

1.1 Scope

This specification establishes the requirements for purified water for use in cleaning the compressor of gas turbine engines where the intent is to restore performance by removing the build up of deposits on compressor components. The water quality defined in this specification applies to water used in both on-line compressor cleaning and crank-soak compressor cleaning.

1.2 Definitions

For the purpose of this specification, the following definitions shall apply:

On-line Compressor Cleaning - A method of removing the build up of deposits on compressor components while the engine is operating. On-line cleaning as accomplished by spraying cleaning solution into the inlet of the engine while the engine is operating.

Crank-Soak Compressor Cleaning - A method of removing the buildup of deposits on compressor components while the engine is motored by the starter. Crank-soak cleaning is accomplished by spraying cleaning solution into the inlet of the engine while the engine is operating unfired at crank speed.

Liquid Detergent - A concentrated solution of water soluble surface active agents and emulsifiable solvents.

Cleaning Solution - A solution of emulsion of liquid detergent and

water or a water and antifreeze mixture for direct engine application. The recommended dilution of liquid detergent and water shall be specified by the liquid detergent manufacturer.

2. Applicable Documents

2.1 Issue of Documents

The following documents shall form a part of this specification to the extent specified herein. Unless a specific issue is specified, the latest revision shall apply.

2.1.1 American Society of Testing and Materials

Available from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

ASTM D1192 Equipment for Sampling and Steam

ASTM D1293 Tests for pH of Water

ASTM D4191 Tests for Sodium in Water by atomic Absorbtion Spectography

ASTM D4192 Tests for Potassium in Water by Atomic Absorbtion Spectography

ASTM D5907 Tests for Filterable and Non-Filterable Matter in Water

ASTM D3370 Practices for Sampling Water

3. Requirements

3.1 Sampling Requirements

The sampling shall be in accordance with ASTM D1192 and ASTM D3370. A

minimum sample of one (1) gallon or four (4) liters shall be supplied.

3.2 Chemical Requirements

The water shall meet the following requirements when tested in accordance with the designated test method.

3.3 Filtration Requirements

The water shall contain no particles larger than 100 microns absolute.

	Limit	Test Method
Total matter, ppm, max	100	ASTM D5907
pH	6.5 - 8.5	ASTM D1293
Sodium + potassium, ppm,max	25	ASTM D4191 & ASTM D4192

Liquid Detergent for Compressor Cleaning for GE Aircraft Derivative Gas Turbines

This specification establishes the requirements for liquid detergent products used to prepare cleaning solutions for cleaning the compressors of gas turbine engines, where the intent is to restore performance by removing the build-up of deposits on compressor components. Such deposits include salt, soils or oils that may be ingested from the atmosphere.

The cleaning process shall be carried out by spraying the cleaning solution into the bellmouth of the engine while the engine is running at power (on-line cleaning) or while the engine is being cranked (crank soak cleaning).

For the purposes of this specification, the following definitions shall apply:

Liquid Detergent - A concentrated solution of water soluble surface active agents and emulsifiable solvents.

Cleaning Solution - A solution or emulsion of liquid detergent in water or a water and antifreeze mixture for direct engine application. The recommended dilution of liquid detergent and water shall be determined by the liquid detergent manufacturer.

1. Applicable Documents

The following documents shall form a part of this specification to the extent specified herein. Unless a specific issue is specified, the latest revision shall apply.

ASTM D88 Standard Test Method For Saybolt Viscosity

ARP 1795 Stress-Corrosion of Titanium Alloys, Effect of Cleaning Agents on Aircraft Engine Materials

AMS 1424 Deicing/Anti-icing Fluid, Aircraft (Newtonian-SAE Type 1)

2. Detergent Properties

2.1 Composition

The chemical composition of the detergent is not limited, other than as specified herein.

2.2 Biodegradability

Use of the liquid detergent/cleaning solution shall conform to local regulations for water pollution. Use of biodegradable ingredients is recommended.

2.3 Toxicity

Use of the liquid detergent/cleaning solution shall conform to local regulations for industrial hygiene and air pollution. Use of nontoxic ingredients is recommended.

2.4 Health and Safety Information

The liquid detergent manufacturer shall make available health and safety information for the liquid detergent as required by applicable local, state and federal regulations.

2.5 Solids

The liquid detergent shall contain no particles larger than 20 micron.

2.6 Physical and Chemical Properties

The liquid detergent shall meet the test requirements.

3. Test Requirements

3.1 Liquid Detergent

3.1.1 Residue or Ash Content

Residue or ash content shall not exceed 0.01 percent when tested in accordance with paragraph 4.1.

3.1.2 Low Temperature Stability

The liquid detergent shall show no evidence of separation of component parts when maintained at $40^{\circ}\text{F} \pm 3$ ($5^{\circ}\text{C} \pm 2$). It is highly desirable although not mandatory that the fluid shall remain liquid below 32°F (0°C).

3.1.3 Cold Weather Solution Compatibility

The liquid detergent shall show no separation, layering or precipitation when mixed to the liquid detergent manufacturer's recommended dilution in one or more of the following antifreeze solutions after 2 hours at $10^{\circ}\text{F} \pm 3$ ($-12^{\circ}\text{C} \pm 2$):

- Isopropyl Alcohol
- Monopropylene glycol (PG)
- Acetone

See paragraph 6.1 for more information regarding liquid detergent and antifreeze mixtures.

3.1.4 Hard Water Compatibility

The liquid detergent shall show no separation or layering when mixed with synthetic hard water prepared in accordance with paragraph 4.2.

3.1.5 Acid and Alkali Acceptance

The liquid detergent shall show no separation, layering or precipitation when tested in acidic or alkali media in accordance with paragraph 4.3.

3.1.6 Salt Water Tolerance

The liquid detergent shall show no separation or gelling when mixed with 3.5 percent salt water in accordance with paragraph 4.4.

3.1.7 Viscosity

The liquid detergent shall have a viscosity of 50 to 200 SUS at 77°F (25°C) when tested in accordance with ASTM D88.

3.1.8 pH

The pH of the liquid detergent as received shall be from 6.5 to 8.5 when measured with a suitable pH meter employing a glass electrode.

3.2 Cleaning Solution

3.2.1 Corrosive Elements

Maximum levels of elements in the cleaning solution which may promote various types of corrosion, shall be no greater than as shown in Table 1, when analyzed by methods in paragraph 4.5.

Table 1. Maximum Corrosives Limit

Total alkali metals (sodium + potassium + lithium, etc.)	25 ppm max.
Magnesium + calcium	5 ppm max.
Vanadium	0.1 ppm max.
Lead	0.1 ppm max.
Tin + Copper	10 ppm max.
Sulfur	50 ppm max.
Chlorine	40 ppm max.

3.2.2 pH

The pH of the cleaning solution shall be from 6.5 to 8.5 when measured with a suitable pH meter employing a glass electrode.

4. Test Methods**4.1 Residue or Ash Content**

Weigh 10 ± 0.1 gram sample of liquid detergent in a weighed 30 ml porcelain crucible. Heat gently to volatilize any water or solvents. (Crucible may be placed in air oven at $105^{\circ}\text{C} \pm 2$ for 24 hours, followed by $240^{\circ}\text{C} \pm 2$ for 24 hours to insure all volatile matter is evaporated.) Finally, ignite contents over Bunsen Burner, first at low temperature under good oxidizing conditions until all ignitable material is consumed, then place a crucible in a muffle furnace at 1040 to 1100°C for 2 hours. Cool in desiccator, and weigh.

Percent residue or ash = $(100 \times A)/W$

Where: A = grams of residue

W = grams of sample

4.2 Hard Water Compatibility**4.2.1 Preparation of Synthetic Hard Water**

A hard water solution is prepared by dissolving the following in one liter of just boiled and cooled distilled water:

- a. 0.20 ± 0.005 gram Calcium Acetate, reagent grade $\text{Ca}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot \text{H}_2\text{O}$
- b. 0.15 ± 0.005 gram Magnesium Sulfate, reagent grade $\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$

4.2.2 Hard Water Test

5 ml of liquid detergent shall be added to a clean 50 ml cylinder. 45 ml of synthetic hard water shall be added and mixed well. The solution shall be examined for compatibility after 16 hours at $77^{\circ}\text{F} \pm 5$ ($25^{\circ}\text{C} \pm 3$).

4.3 Acid and Alkali Acceptance

The liquid detergent shall be mixed with distilled water in accordance with the liquid detergent manufacturer's recommended dilution. To 50 ml of the solution, add 1 ml of 75 percent phosphoric acid. To another 50 ml of the solution, add 5 ml of 75 percent phosphoric acid. To another 50 ml of the solution, add 1 ml of 50 percent potassium hydroxide. Let all three mixtures stand for one hour at $77^{\circ}\text{F} \pm 5$ ($25^{\circ}\text{C} \pm 3$), and then examine for acid or alkali acceptance.

4.4 Salt Water Tolerance

Prepare a 3.5 percent by weight solution of sodium chloride in distilled water. Add 15 ml of salt solution to 35 ml of liquid detergent and let stand for 1 hour at $77^{\circ}\text{F} \pm 5$ ($25^{\circ}\text{C} \pm 3$). Examine for salt water tolerance.

4.5 Elemental Content

Elemental content shall be determined using the following methods:

Element	Method
Sulfur, Phosphorous	Inductivity Coupled Plasma Spectroscopy - Atomic Emission Spectroscopy (ICP-AES)
Chlorine	Microcoulometric filtration
Sodium, Potassium	Atomic Absorption (AA)
Other metals	ICP-AES or AA

5. Material Compatibility

5.1 Compatibility with Engine Materials

Use of the detergent gas turbine cleaner shall not have adverse effects on engine system materials such as titanium stress corrosion, hot corrosion of turbine components or damage to lubrication system components.

5.2 Titanium Stress Corrosion

A titanium stress corrosion test in accordance with ARP 1795 or equivalent may be run on the liquid detergent at the discretion of GE.

6.1 Cold Weather Usage

In cold weather, liquid detergent must be added to antifreeze mixture rather than to water alone. At present, the only acceptable antifreeze solutions are:

- Isopropyl Alcohol
- Monopropylene glycol (PG)
- Acetone

Monopropylene glycol (PG) must be per AMS 1424 and may be used down to 20°F (-7°C)

Antifreeze mixtures are shown in Table 2. The liquid detergent manufacturer must specify which, if any, of the antifreezes specified above is not compatible with the liquid detergent.

The use of non-isopropyl alcohol, ethylene glycol or additives containing chlorine, sodium or potassium are not permitted since they may attack the titanium and other metals in the gas turbine.

It is extremely important that the liquid detergent and antifreeze solution be a homogeneous mixture when sprayed into the bellmouth of the gas turbine. If after 2 hours the liquid detergent and antifreeze solution separates, (see paragraph 3.1.3) agitation of the mixture in the wash water tank is permissible. However, the liquid detergent manufacturer shall specify that agitation is required.

Table 2. Water Wash Antifreeze Mixtures.

Compressor Washing Antifreeze Mixtures						
Outside Air Temp, °F (°C)	Monopropylene glycol (PG) % Vol	H2O % Vol	Acetone % Vol	H2O % Vol	Isopropyl Alcohol % Vol	H2O % Vol
+20 to +50 (-7 to 10)	21	79	25	75	22	78
+10 to +20 (-12 to -7)	N/A	N/A	40	60	34	66
0 to +10 (-18 to -12)	N/A	N/A	53	47	47	53
-10 to 0 (-23 to -18)	N/A	N/A	63	37	72	28
-20 to -10 (-29 to -23)	N/A	N/A	69	31	88	12
-30 to -20 (-34 to -29)	N/A	N/A	75	25	97	3
Compressor Rinsing Antifreeze Mixtures						
Outside Air Temp, °F (°C)	Monopropylene glycol (PG) % Vol	H2O % Vol	Acetone % Vol	H2O % Vol	Isopropyl Alcohol % Vol	H2O % Vol
+20 to +50 (-7 to 10)	14	86	20	80	18	82
+10 to +20 (-12 to -7)	N/A	N/A	33	67	27	73
0 to +10 (-18 to -12)	N/A	N/A	43	57	39	61
-10 to 0 (-23 to -18)	N/A	N/A	50	50	58	42
-20 to -10 (-29 to -23)	N/A	N/A	55	45	70	30
-30 to -20 (-34 to -29)	N/A	N/A	60	40	77	23

Lubricating Oil Specification for GE Aircraft Derivative Gas Turbines

This document provides the requirements and application guidelines for selection of lubricating oils which can be satisfactorily utilized in GE Marine and Industrial Aeroderivative Applications. It is recommended that the lubricating oil selected be reviewed with GE prior to its use.

1.0 Oil Specifications

Oils conforming to the US Department of Defense (DoD) Specifications shown in paragraph 2.1 are acceptable for use in GE Aircraft Derivative gas turbines, provided they are listed on the Qualified Product List (QPL) for the specific Specification.

1.1 Commercial Specifications

Commercially available synthetic based lubricating oils, per the Supplier's Specification, are acceptable for use in GE Aircraft Derivative gas turbines, provided they are listed in Section 4 of this document. Such oils largely conform to the primary requirements of the oils in Section 1.0, but certain variations have been approved. Such oils have been qualified by the Supplier to meet the requirements of this document.

2.0 Applicable Documents

The following documents shall form a part of this document to the extent specified herein. Unless a particular issue is specified, the latest revision shall apply.

2.1 US DoD Specifications

MIL-PRF-23699 Lubricating Oil, Aircraft Turbine Engines, Synthetic Base

MIL-L-7808 Lubricating Oil, Aircraft Turbine Engines, Synthetic Base, Type 1

2.2 American Society of Testing and Materials.

The following documents are available from American Society for Testing and Materials, Customer Service, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959:

ASTM D2532 Low Temperature Viscosity

ASTM D97 Pour Point

ASTM D445 Kinetic Viscosity

3.0 Requirements

The lubricating oil shall conform to the requirements of MIL-PRF -23699, however, exceptions to the following requirements will be considered:

- Low temperature Viscosity when tested per ASTM D2532.
- Pour Point when tested per ASTM D97.
- Viscosity at 40°C and 100°C when tested per ASTM D445
- Base Stock Composition

The specific variations to MIL-PRF-23699 shall be provided by the oil supplier, along with performance difference impacts, for review by GE.

3.1 Material Compatibility

The lubricating oil shall be compatible with the same elastomer seal and metallic materials as the MIL-PRF-23699 compliant lubricating oils are.

The lubricating oil shall be mixable with MIL-PRF-23699 or MIL-L-7808 compliant oil in a ratio of up to 5% of either oil, without adversely affecting the property integrity of the majority, or operating, oil. Mixing of oils is not intended, but will result due to engine location changes.

4.0 Qualification

Lubricating oil shall be considered qualified and acceptable for use in GE Aircraft Derivative gas turbines demonstrating conformance to the requirements and after being listed in paragraph 4.4. The qualification program shall be carried out by the oil supplier in conjunction with a sponsoring gas turbine owner/operator. GE's participation will be limited to technical consultation, review and final approval only.

4.1 Performance Tests

The oil supplier shall conduct tests in accordance with the requirements of MIL-PRF-23699 and compare the results with the requirements stated therein. All results, and specifically the variations to MIL-PRF-23699 requirements, shall be reviewed with GE prior to initiation of Service Evaluation Testing. Specifically, the material presented for review shall include, as minimum, the following:

- Physical/Chemical Properties and variations to MIL-PRF-23699
- Expected impact to operating systems due to Property variations
- Material Compatibility Lists & Test results
- Oil Coking Test Results

4.2 Service Evaluation Tests

The oil shall undergo service evaluation testing in a LM Series gas turbine application(s). The sponsoring operator will accept total responsibility for all results related to operating with the candidate lubricating oil. The service evaluation engine shall have a known hardware condition baseline, based on depot inspection or new delivery, immediately prior to the service evaluation test.

Service evaluation testing shall be conducted on a minimum of three LM series gas turbines, each accumulating at least 8,000 operating hours, at a baseload operating site, prior to inspection. During operation, periodic oil samples shall be tested and trended for physical and chemical property changes. Inspection shall be performed at an authorized depot, and shall be in accordance with the applicable repair manual.

Inspection shall be focused on the oil wetted parts, including the bearings, gears, elastomer seals, sump oil seals, actuators, and lube/hydraulic pumps. GE will be permitted to witness any of the inspections, at the discretion of GE.

4.3 Qualification Report

The oil supplier, and/or operator, shall prepare and submit a Final Qualification Report to GE. The report shall include, as a minimum, the following:

- Oil Brand Description including the complete formulation
- Certified physical, chemical and performance test results
- Material Safety Data Sheets
- Service evaluation test history including all significant operational and maintenance events
- Service evaluation oil sample trending results
- Final depot engine inspection results

Upon final review and approval of the Final Qualification Report by GE, the candidate oil will be included on the approved oils list.

Formulation changes affecting any approved performance characteristics must be reviewed with GE for impact on qualification results.

4.4 Approved Lubricating Oils

In addition to the oils listed on QPL-23699 and QPL-7808, (Qualified Products List), the following lubricating oils are approved for use in GE Aero Derivative gas turbines and gas generators:

1. None at this time.



GEK 107158A
Revised, January 2002

GE Power Systems
Gas Turbine

**Water Supply Requirement for Gas Turbine Inlet Air
Evaporative Coolers**

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes the matter should be referred to the GE Company.

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I. INTRODUCTION

Evaporative coolers supplied with GE Gas Turbines should provide reliable and trouble free operation for the life of the gas turbine. The GEK is intended to help the operator in the choice and treatment of water for the evaporative cooler. The use of suitable water is essential in minimizing carryover, preventing corrosion and scale formation and in obtaining the expected service life and performance from the evaporative cooler. The evaluation of the water supplies to be used in the evaporative cooler should be done as early as possible. All the critical factors, which bear on suitability, must be considered in making a choice. Details of the evaluation procedure are given in Section III and in Appendix 2.

Gas turbine operators must recognize that if suitable water treatment guidelines are not established and followed, the evaporative cooler and its media may need more frequent maintenance. In the extreme case the need for premature media replacement could result. Furthermore, poor water quality and/or the misoperation of the cooler can result in severe contamination of the gas turbine and have extremely serious consequences in terms of forced outage time needed for maintenance, repair and replacement of gas path components.

The scope of this GEK is limited to cellulose media type evaporative coolers and the water quality related to such equipment.(1) The water quality required to operate Gas Turbine Air Inlet Foggers and Inlet Air Chillers is not covered by the guidelines in this document.

A. Background

Evaporation of water is one of the simplest and oldest methods of cooling air. Even with the sophisticated technology available today, including mechanical chillers, absorption chillers and thermal energy storage systems, evaporative cooling remains a most cost-efficient method for temperature control of the gas turbine inlet air supply.

- Uses industrial quality water
- System is simple and reliable when installed and operated correctly
- Can provide an increase in output. For typical values refer to GER 3567.

Traditional evaporative coolers consist of recirculated water sprayed over an extended surface media mounted downstream from the inlet air filters. As inlet air passes through the media, evaporation occurs, cooling takes place and the water vapor content of the air approaches saturation. These two processes, cooling and approach to water vapor saturation, increase the density of the air, which in turn increases the mass flow and output of the turbine.

Due to the isolated locations of some of the installations, and the limited water sources often available, the use of the evaporative cooler to condition inlet air for the gas turbine results in some very challenging water control requirements. The water available ranges from brackish, with extremely high mineral concentrations, to demineralized water, which may have been prepared as HRSG feedwater or for turbine injection for NO_x control.

The media used in the coolers have been designed to give a highly efficient drift (carryover) free evaporative cooling surface over a wide velocity range. The use of high mineral content waters can result in scale formation in the media, which decreases the efficiency of the cooler and increases the static pressure drop. Conversely, the use of very high purity water can result in corrosion problems and have a destabilizing effect on the cooler media.

B. Evaluation of Water for and Evaporative Cooler

Prior to the commissioning of a new evaporative cooler, either in a new plant or as an add-on to an existing plant, the water to be used for the makeup supply must be evaluated. To allow a complete pre-operational evaluation, all the critical parameters describing the water chemistry must be determined.

Since the water will be used as a makeup source to the circulating water in the evaporative cooler, and not as a once through supply, its chemical properties must be calculated after a number of cycles of concentration. This is essential so that the water chemistry can be estimated at the design operating conditions of the cooler.

The methods for assessing the expected behavior of the water in terms of its potential for scaling, fouling and carryover to the gas turbine, are explained in detail in section III and in the appendices.

As the result of wide seasonal changes in temperature and rainfall, at many sites there may be significant variations in the chemistry of the water at different times of the year. It is essential that the effects of these changes on the water supply to the cooler be known and this will require water analyses which have been conducted at different times of the year.

No parameter should predominate in deciding how the water supply will be used; all critical parameters must be evaluated and the most limiting one will control.

An example of the calculation procedure for the evaluation of a water supply is given in Appendix 2 and the procedure for monitoring the water in the cooler during the first months of operation is given in Appendix 3.

II. DESCRIPTION OF THE SYSTEM

A schematic of an evaporative cooler is shown in Figure 1.

The correct installation, setup and checkout of the cooler are critical to its operation, particularly to the prevention of carryover (drift) of liquid droplets in the outlet air. The installation instructions provided by the manufacturer of the evaporative cooler shall be followed. In addition all evaporative coolers shall undergo commissioning per the latest GE Evaporative Cooler Commissioning procedure (1) prior to initial start up and, during service, a minimum of once a year, at the beginning of the evaporative cooler use season.

III. TREATMENT OF WATER IN EVAPORATIVE COOLING SYSTEMS

In order to give suitable control it is required that the chemistry of the water in the cooler should be monitored continuously.

The critical parameters are:

- Hardness
- Chloride
- Alkalinity
- Alkali metals (Na+K)
- pH

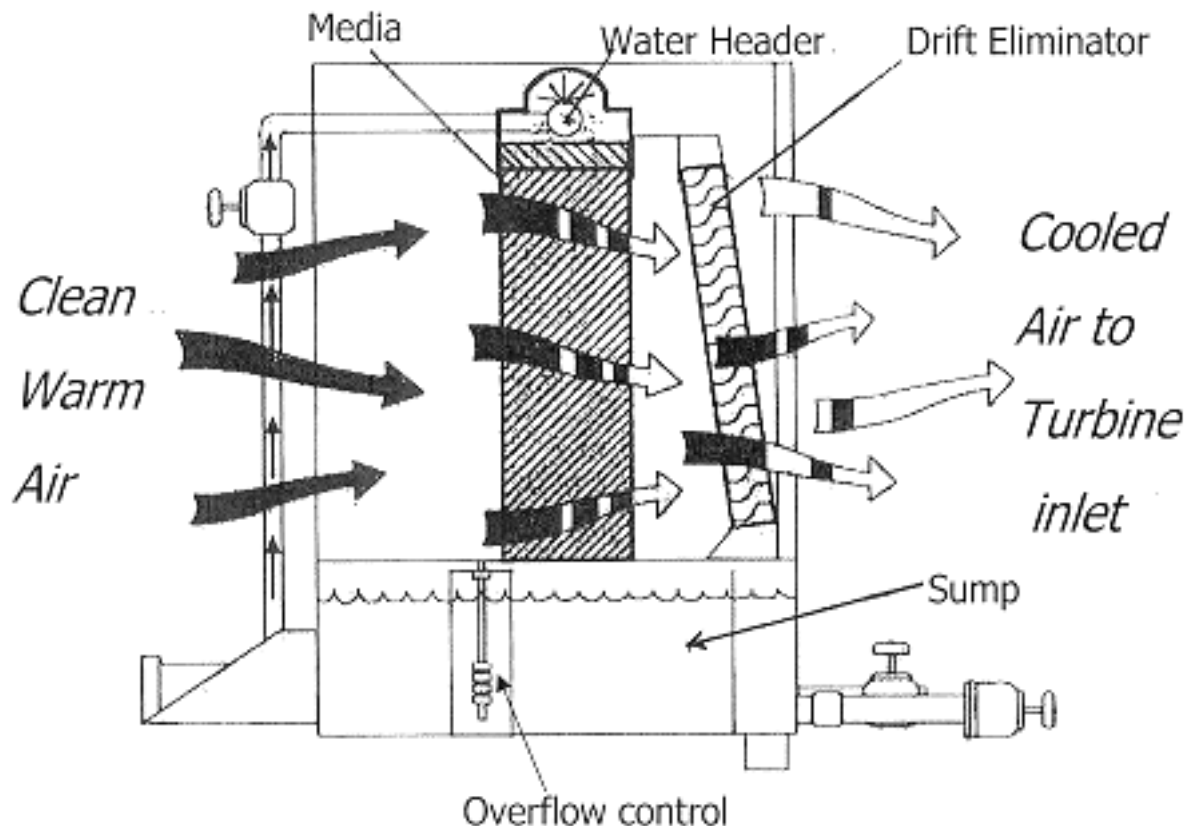


Figure 1. Schematic of Evaporative Cooler

- Scaling Index

The first five are measured properties and the sixth is calculated from them. The most convenient parameter to monitor continuously is conductivity of the sump.

Limits are given for all these properties in Table 3. In a particular water supply one parameter will be limiting and this will control the use of the water. The limiting parameter may be different from water to water. This is discussed in detail and an example of an evaluation calculation is given in Appendix 2.

In the evaporative cooler there are two main goals for the water treatment programs.

- Prevention of fouling, scaling, corrosion and media deterioration in the cooler.
- Prevention of corrosion from carryover of solid contaminants into the gas turbine

These are related but separate issues.

Scale build-up will foul the media, affect operating efficiency and reduce the service life of the media.

Corrosion will reduce the service life of the framing, sumps, piping, and support systems.

Microbiological infestation can foul the media and affect operating efficiency. It can also produce objectionable odors downstream, reduce the service life of the media, and induce corrosion in the piping and sump.

Carryover into the gas turbine can result in corrosion and fouling in both the compressor and turbine sections.

A. Scaling

Scale formations occur when soluble salts are deposited from the recirculating water and the principal factors affecting the rate of formation are:

- Temperature
- pH
- Dissolved solids and hardness contents of the recirculating water

Four problems are associated with scale formation in evaporative cooling units:

- Uneven airflow and water distribution.
- Increase in pressure drop through the unit, due to plugging of the media.
- Decreased evaporation surface area.
- Locally high pH conditions under deposits which cause loss of the binder and delignification of the fibers of the evaporative cooling pad.

Scale formation can be prevented in evaporative coolers by:

- a. Maintaining a scaling index which is slightly on the scale dissolving side of neutral, Puckorius Scaling Index (PSI) > 6.5 .
- b. Pre-treatment of the raw water by demineralization (reverse osmosis, ion exchange), to remove hardness.

CAUTION

Na Zeolite softened water should never be used. A voluminous deposit of sodium carbonate may form on the media.

- c. Inhibiting scale adhesion by using a crystal modifying chemical treatment.

1. Prevention of Scaling in the Cooler

The water circulated through the cooler must be compatible with materials of construction and particularly with the media. The blocks which comprise the media are molded from a composite of paper fibers and an inorganic binder. The geometric design of the blocks has been optimized for effective evaporation and minimal pressure drop. The chemistry of the circulating water is critical in maintaining a high operating efficiency and long life for the media

2. Scaling Index

The parameter which has been found to be most effective in defining the required chemistry for the circulating water in the cooler is its Scaling Index. Indices were developed for the specification and control of water in cooling towers and the water-side of shell-tube heat exchangers. There are three

indices in use and they relate the alkalinity, hardness and pH of cooling water, at its operating temperature, to its tendency to be scaling or corrosive.

The indices are:

Puckorius or Practical Index (PSI)

Ryznar Index (RSI)

Langelier Index (LSI)

Table 1 Scaling Index Values

Scaling Index Values		
PSI & RSI	LSI	Condition
3	3	Extreme Scaling
4	2	Very Severe Scaling
5	1	Severe Scaling
5.5	0.5	Moderate Scaling
5.8	0.2	Slight Scaling
6	0	Stable
6.5	-0.2	No Scale, very slightly corrosive/tendency to dissolve scale
7	-0.5	No scale, slightly corrosive/tendency to dissolve scale
8	-1	No scale, moderately corrosive/tendency to dissolve scale
9	-2	No scale, strongly corrosive/tendency to dissolve scale

Scaling indices are calculated using total dissolved solids, (which is not measured directly but is derived from the conductivity), temperature, calcium hardness, total alkalinity and pH of the water. Each parameter is used in weighted formulae to determine whether the water is scale forming or scale dissolving, and the extent to which it is either. For evaporative cooling, it is desirable to maintain the water so that it has a slightly scale dissolving index. In doing so, the recirculating water has the ability to dissolve mineral deposits. However, the water should not be so aggressive (scale dissolving) that it softens the media.

The definitions and methods for calculating the indices are shown below and specific examples, with different water chemistries, are shown in the Appendix 2, Calculation 1.

$$PSI = 2(pH_s) - pH_{eq}$$

$$RSI = 2(pH_s) - pH_{measured}$$

$$LSI = pH_{measured} - pH_s$$

$$pH_s = 9.30 + (A + B) - (C + D)$$

$$pH_{eq} = 1.465 (\log(TA) + 4.54)$$

The factors are defined in Table 5 of Appendix 2.

A – Factor for total dissolved solids

B – Factor for temperature

C – Factor for calcium hardness (as ppm CaCO_3)

D – Factor for alkalinity (as ppm CaCO_3)

TA – denotes total alkalinity

E - Factor for pH_{eq}

The recommended control ranges for the water in the evaporative cooler, in order to give high reliability and long life of the cooler media, are shown in Table 2.

Table 2
Recommended Values of Scaling Indices for Recirculating Water in Evaporative Coolers

Langelier Saturation Index (LSI)	0.5 +/- 0.25
Ryznar Stability Index (RSI)	6.0 +/- 0.5
Puckorius (Practical) Stability Index (PSI)	6.5 +/- 0.5

3. Control of the Scaling Index

The factors, which control the scaling index, are interdependent and controlling each of them separately is not possible. For example, changing the hardness, by deionizing, will also affect the alkalinity and pH of the water. Practically the scaling index is set by the chemistry of the makeup water and the number of cycles of concentration that it is put through.

B. Establishing the Chemistry of the Cooler Recirculating Water

The chemistry of the sump will be established by determining the maximum cycles of concentration that the makeup water can go through and give recirculating water, which has a Puckorius scaling index of 6.5 (+/- 0.5), as identified in table 2, and meets the other requirements shown in Table 3.

Makeup water is added to the sump of the evaporative cooler to replace the water lost by evaporation plus that removed from the sump as blowdown or bleed-off.

The following formula can be used for determining the evaporation rate for an evaporative cooler.

The formula is not as accurate as using a psychrometric chart; however, it provides the evaporation rate within an acceptable approximation of the true rate and it is easy to use.

$$\text{Evaporation} = \frac{\text{ACFM (Thousands)} \times (\text{EDBT} - \text{LDBT})}{500}$$

$$\text{Evaporation} = \text{Gallons per minute}$$

ACFM = Actual Cubic Feet Per minute of Air passing through the cooler.

EDBT = Entering Dry Bulb Temperature (°F)

LDBT = Leaving Dry Bulb Temperature (°F)

NOTE

When determining make-up water requirements for an evaporative cooler always use the evaporation and blowdown calculated for worst case.

The water added as makeup will have known total dissolved solids content as determined by its conductivity. For estimating purposes:

Conductivity (in $\mu\text{S}/\text{cm}$) * 0.6 = TDS (in ppm) (Ref 3)

The calculation procedure is shown in calculation 4 of Appendix 2. An example of a scaling factor calculation is shown in calculation 2 of Appendix 2.

Water always contains a certain amount of dissolved minerals. The process of evaporative cooling removes water as vapor from the recirculating flow and leaves behind the solids which had been dissolved in the water when it was added as makeup. Accordingly, enough water must be blown down from the recirculating flow to control the level of these solids and to avoid build-up of insoluble minerals on the pad surface (scaling), which results in an increase in pressure drop and a loss of evaporation efficiency.

The amount of bleed-off required is determined from the following formula:

$$\text{Blow Down} = \frac{\text{Evaporation Rate}}{(\text{cycles of concentration} - 1)}$$

When the blowdown and evaporation rates are known the makeup can be calculated.

$$\text{Makeup} = \text{Blowdown} + \text{Evaporation}$$

- a. At initial startup of an evaporative cooler, the makeup water required will be higher than the steady state makeup to allow for the initial wetting of the evaporative cooler.
- b. If conductivity control is used to control blowdown, the makeup water required while blowdown is on will be higher than the average identified by the formula “makeup = blowdown + evaporation” and while the blowdown is off, the required makeup rate will be equal to the current evaporation rate.

The maximum cycles of concentrations that can be maintained, using the available make-up water source and the maximum evaporation rate define the maximum required blowdown. Control of these parameters will in turn control the chemistry of the recirculating water. Conversely, knowing the chemistry requirements for the recirculating water, in terms of scaling index, alkali metal and chloride concentration, will allow the system designer and operators to define the cycles of concentration that a particular makeup can accept.

1. Iron and Manganese. (Ref 4)

The presence of dissolved iron and manganese in the makeup water can cause black oxide fouling of the cooler media and also can lead to severe bacterial infestation of the media, sump and circulating water system. The oxide fouling can severely affect the performance of the media and lead to the need for premature replacement.

Iron is present in all water supplies. At levels below 0.1 ppm in the makeup it should not cause fouling problems.

Manganese is less commonly found but should be controlled in the makeup below 0.05 ppm.

If use of iron or manganese bearing waters is necessary, pre-treatment to remove them, usually by coagulation and filtering, will be required. These heavy metals can also cause severe fouling in membrane pretreatment systems.

Copper will not usually be found in raw water but may be picked up if copper-bearing piping is in use.

The total heavy metals in the water used for makeup should not exceed the limit given in Table 3.

2. Silicates

Silicates form a number of different scale complexes with calcium, magnesium, aluminum, sodium, and iron. The usual control procedure is to maintain the silica level in the evaporative cooler recirculating waters below 100 PPM.

In most parts of the country maintaining this limit presents no problem and at least 4–5 cycles of concentration can be attained, based on silica content. However, in some southwestern areas, it is not unusual for raw water silica (as SiO) levels to reach 60–90 PPM. This severely restricts the cycles of concentrations that can be attained.

3. Blowdown Control

Two methods are commonly used for controlling blowdown, which is required to maintain the desired chemistry in the sump of the evaporative cooler.

Constant flow – The simplest is to set a valve on the pressure side of the recirculating pump to continuously discharge a constant flow of water to drain. Installing a flow meter at the point of blowdown will help operators monitor and set the blowdown rate. The amount of water discharged in this method is normally calculated using the highest evaporation rate and the method does not allow for any fluctuations in evaporation rates and often wastes water. The set point can be changed periodically to accommodate seasonal changes in evaporation rates.

Conductivity control – Evaporation rates fluctuate due to changes in ambient temperature and humidity. These fluctuations can be accommodated by controlling the blowdown, based on the conductivity of the recirculating water. This is accomplished by installing a conductivity controller in the system. It continuously measures the conductivity until the measurement surpasses the desired set point. It then opens a solenoid valve and blows down water until the conductivity is back within control range. This is the only practical continuous control method.

C. Makeup Water

Prior to the commissioning of the plant the first step in the water treatment process is the selection of a water source for the evaporative cooler. In most plants there are several sources of make-up water. There may be one or more supplies of raw water, from wells, lakes or rivers, potable water from a municipal source and treated water that has been demineralized by ion exchange or reverse osmosis. Evaluation of the various sources should be made to determine the optimum source of make up water, including not only the requirements of the gas turbines but also the costs of supply and discharge for the water sources evaluated.

The makeup water for the evaporative cooler should meet the following criteria :

- Capable of acceptable cycles of concentration, while maintaining a suitable scaling index
- Having sufficient flow available to support the maximum evaporation and blowdown rates expected, and the maximum flow rate required at startup of the evaporative cooler.
- Satisfy the requirements of this GEK.
- Water should be supplied to the cooler at ambient temperature. The use of makeup water with a temperature above the ambient air dry bulb temperature can significantly reduce the effectiveness of the evaporative cooler.

Makeup water is added to the sump to replace the water lost through evaporation. Since this makeup water contains dissolved minerals, the mineral content of the recirculating water gradually increases. Dividing the concentration of the minerals in the recirculating water by the same concentration of minerals in the makeup water gives a ratio that is referred to as "cycles of concentration."

In evaluating a makeup source all the requirements of the recirculating water must be checked.

In Appendix 2, concentration cycles have been calculated for a makeup and compared to the limits in Table 3.

Makeup and recirculating water with parameters that are outside the recommended levels must be evaluated on an individual basis.

1. Use of Demineralized Water

Where the available water supply is too hard or contains too high solids to be suitable for makeup, some treatment prior to use is required. This may involve demineralization by reverse osmosis or ion exchange.

Demineralized water is not recommended as a once through water supply for evaporative coolers or as the sole source of makeup for recirculating water systems in evaporative coolers, without appropriate chemical control.

The use of this high purity water is discouraged for the following reasons:

- Corrosion and corrosion–erosion of piping and metallic materials of construction in the cooler.
- Evaporative cooler media are a composite made from paper fibers supported by inorganic binders, or stiffening agents. High purity waters may dissolve the binders. This could result in loss of rigidity causing media "sagging" and a significant reduction in media life.
- The treated water may delignify the fibers in the media and shorten the service life.

Rather than have treated water as the sole source of makeup, or for once through use, it is usually both more cost effective and technically desirable to blend the demineralized product with raw water to produce a medium solids makeup, which meets the makeup requirements in Table 3, and can be recycled in the evaporative cooler to acceptable cycles of concentration.

If 100% pretreated water must be used, the system pH should be maintained at 7.5–8.0, which may require chemical addition for pH control.

The use of blended or treated water is appropriate when the raw water has a high silica content, in areas of limited makeup water, and in locations where water use and discharge restrictions exist.

2. Once-Through Water

While the use of once-through water for the evaporative cooler is not recommended, it is important that when this practice is utilized the following guidelines should be followed:

- a. If the raw water supply has a Practical Scaling Index in excess of 8.0, reduce the water flow to 0.75–1.0 GPM per square foot of top media surface area. Request information from your GE representative for optimum pipe size, hole size and spacing.
- b. If raw water supply has a Practical Scaling Index of 5.5–8.0, use normal recommended water flow rates.
- c. Do not use water which is strongly scale dissolving ($PSI > 8$) as a once through supply.
- d. Do not use water containing free chlorine or bromine.
- e. Water should be cool and pipes run underground, if necessary to prevent warming.

D. Recommendations for Makeup and Circulating Water in Evaporative Coolers

GE's recommendations for makeup and circulating water chemistries for evaporative coolers in use with gas turbines are given in Table 3.

Table 3
Recommended Concentrations in Water for Gas Turbine Inlet Evaporative Coolers

Constituent	Makeup	Circulating water (see note 3)
Specific Conductivity, $\mu S/cm$	> 50 (see note 2)	< 5000 (see note 4)
Total Dissolved Solids, ppm	> 30 (see note 2)	< 3000
Total Alkalinity, ppm (as $CaCO_3$)	> 15 (see note 2)	< 500
Calcium Hardness, ppm (as $CaCO_3$)	> 15 (see note 2)	< 500
Alkali metals, ppm, (Sodium + Potassium)	No minimum	< 550
Chlorides, ppm, (as Cl)	No minimum	< 300
Silica, ppm, (as SiO_2)	No minimum	< 100
Heavy metals, ppm, (Fe, Mn, Cu, V, Pb)(see note 1)	< 0.2 (Total)	1.0 Total
Fe	0.1	1.0
Cu	0.05	0.5
Mn	0.05	0.2
Oil and Grease, ppm	< 2.0	10
Suspended Solids, ppm	< 5	30
pH	7-8.5	7.0- 9.0

Notes

- 1) Iron, manganese and copper act as foulants at the pH conditions in the cooler and their levels in makeup should be controlled. In the sump, the limit for total heavy metals is 1.0 ppm and that for Mn is 0.2 ppm. Vanadium and lead are not found in ground waters and are mentioned only because of their severe corrosive effect in the turbine hot gas path.
- 2) The minimum values are for protection of the media when treated or blended water is being used. No maximum values are given for the makeup water since the values must be evaluated based on the capability of the makeup to give acceptable cycles of concentration.
- 3) The values are estimates for the circulating water to be maintained with six (6) cycles of concentration and an acceptable scaling index level.
- 4) A limit on the specific conductivity of 5000 $\mu\text{S}/\text{cm}$ is given. However in “Evaporative Cooler Commissioning Procedure Document” (ref 1) it is recommended that the control system is set so that blowdown from the sump of the evaporative cooler is initiated at 1000 $\mu\text{S}/\text{cm}$ and continued until a value of 800 $\mu\text{S}/\text{cm}$ is reached. When the cooler system is operational and sump water testing has been carried out, the conductivity range for the start and stop of blowdown can be set at values that match plant experience and the requirements of this GEK.
- 5) Each water supply should be evaluated as described in this GEK. Where operators have questions regarding the requirements, they should contact GE for consultation.

IV. OPERATING ISSUES

Maintaining a high purity air stream to the gas turbine is dependent not only on control of the recirculating water chemistry but also the following operating factors.

A. Water Flow Rates and Distribution

Using recommended water flow rates in conjunction with even water distribution across the entire media bank is the recommended, and most successful, means of minimizing or eliminating scale deposition. The constant washing of the face of the media with an acceptable volume of water will continuously clean and flush the media surface.

The evaporation rate is independent of the wetting rate. If less than the recommended water is supplied to the media, two things may occur, both of which have a negative effect. First, with lower water flow rates, concentrated mineral salts will accumulate faster, and secondly, there may be insufficient water on the face of the media to provide the washing action. There shall be 1.5 gallons per minute of water per square foot of top media surface area distributed over the media. This will result in a minimum of 1.0 gallons per minute of water per square foot of media surface area draining out the bottom of each bank of media. The water draining out the bottom will vary depending on the daily evaporation rate.

B. Proper Air Distribution

Uneven air distribution due to obstructions, fan placement, inadequate transitions, fouling, etc., will cause high velocity zones, which may lead to water droplet carryover.

C. Maintaining the Media

Heavily fouled or damaged areas in the media are often a source of carry over. Heavily fouled media should be replaced, minor damage to media should be cut out and smoothed off. Major damage to media requires the entire pad to be replaced.

D. Chemical Treatment of the Circulating Water

Chemical treatment programs which were designed for controlling scale in cooling towers should not be used for evaporative coolers.

In evaporative coolers the media surface has relatively much less water flowing over it and is subjected to many wet/dry cycles. When mineral concentrations in the water become too high, because of too many cycles of concentration and/or insufficient water flow over the media surface, mineral salts precipitate and deposit. In such a mechanism, the use of scale inhibitors will have little or no positive effect and in fact the scale inhibitors will become part of the scale deposit. Thus, conventional cooling tower water treatment methods do not apply to evaporative coolers.

E. Chemical Treatment for Scale Modification

Proper chemical residuals must be maintained in the system.

The recommended treatment approach is the use of crystal modifiers such as sulfonated polystyrenes and polymaleic acid.

F. Control of Biological Fouling

Uncontrolled growth of bacteria, and other organisms, can lead to plugged media, metal deterioration, and undesirable odors in the air supply.

An effective program to control algae, bacteria, fungi, molds and yeasts is an essential part of any water treatment program for the evaporative cooler.

A biocide program, appropriate for gas turbine application, should be implemented to provide effective control of the microbiological problems.

Biological control should not be used in place of good housekeeping.

The recommendations of the manufacturers of the evaporative cooler and its media should be followed in establishing a housekeeping program for the water system in the cooler.

G. Chemical Control of Corrosion

The following recommendations should be followed if corrosion of the materials in the cooler is observed:

1. Review the problem with GE Power Systems.
2. Establish a corrosion monitoring program utilizing representative corrosion coupons.
3. Do not use phosphate based inhibitors. They provide nutrients for growth of micro-organisms and interact with calcium salts to increase scale deposition.

4. Whenever possible use an all-organic treatment program since it combines effective scale and corrosion inhibition.
5. If a steel corrosion inhibitor is required, use molybdate.

V. PROTECTION OF THE GAS TURBINE

The gas path of the turbine is susceptible to fouling and deposition by contaminants entrained in the air, fuel, water and steam passing through it. The contours of airfoils, and the clearances between them, are affected and, when fouling becomes severe, reductions in both efficiency and turbine output occur.

The contaminants most commonly causing fouling are soot and other airborne carbonaceous particles, silica, iron oxides, calcium sulfate and carbonate, with lesser amounts of sodium and potassium chlorides and sulfates. With use of evaporative coolers, the deposits tend to contain more salts of the alkali (Na + K) and alkaline earth (Ca + Mg) metals. The increase in alkali metal salts can result in more rapid accumulation of deposits and more corrosion in both the compressor and turbine sections.

The carryover of solid contaminants can result in several problems:—

- chloride ion pitting of 400 series stainless steel compressor blades
- alkali metal (sodium + potassium) hot corrosion of turbine hot gas path components.
- loss of compressor performance due to fouling
- general corrosion of ducting

The corrodants of concern are chloride ion, which can cause pitting damage to the stainless steels in the compressor and the alkali metals, sodium and potassium, which can cause hot corrosion in the turbine gas path.

A. Corrosion of the Compressor

The airfoils of the compressor are subject to pitting corrosion when contaminated with deposits containing chloride ions. Since most of the stages of a compressor run dry, corrosion occurs during only shut-down periods when deposits become hydrated. The inlet stages 1–4 run wet and, if chloride contamination is present, may corrode during operation.

B. Hot Corrosion of the Turbine Hot Gas Path

Sodium and potassium salts react with sulfur oxides in the combustion gas to form sulfates, which are molten at the metal temperatures of the combustion system and hot gas path of the turbine. The high temperature gas turbine components are stable in the high temperature, oxygen rich environment because of a tightly adherent oxide layer on their outer surfaces. The molten sulfates dissolve this oxide scale and prevent its reformation. They also penetrate the metal structure causing sulfidation, which further weakens the alloys. The presence of only parts per billion (ppb) of alkali sulfates in the combustion gas is sufficient to cause condensation of salts on metal surfaces and very rapid corrosion the gas turbine hot gas path parts. The rate of attack is directly proportional to the level contaminants present and there is no materials solution for hot corrosion, which must be prevented by controlling contamination.

C. Protection of the Hot Gas Path - Contaminant Limits

The allowable limits, for sodium plus potassium in the turbine combustion gas, have been defined in references 5 and 7.

- Alkali Metal - 20 ppb in combustion gas for EA and FA turbines
- 10 ppb for FB, H turbines
- If Fuel/air(f/a) = 0.02 fuel alkali limit is 0.5 ppm (500 ppb) for EA and FA,turbines (GEI41047)

If f/a is higher than 0.02, as with a lower BTU synfuel, the allowable alkali is reduced accordingly.

- Air alkali metal limit is 0.005 ppm (5 ppb Na+K) as Na

Carry-over limits on contaminants in the individual flows to the turbine may be obtained from a mass balance .

$$T^*(X^T) = S^*(X_S) + F^*(X_F) + A^*(X_A) + W^*(X_W)$$

Where T = total mass flow to turbine,

X_T = alkali metal in flow = 20 ppbw

A = Air flow,

X_A = concentration in air

F = Fuel flow,

X_F = concentration in fuel

S = Steam flow,

X_S = concentration in steam

W = Water flow,

X_W = concentration in water

In GER 3419A, "Gas Turbine Inlet Air Treatment", it is stated on page 3: "When trace metals in the fuel, water or steam are not precisely known, a limit for these contaminants in the inlet air of 0.005 ppm will nominally be set."

Using this value of 5 ppb for Na + K in the air, the maximum alkali metal ion content which is allowable in the evaporative cooler water can be calculated.

1. Carryover Control.

Information from Munters, a leading manufacturer of the cooler media, states that based on laboratory test data, the maximum drift or carry over rate is 0.0033% = 33 lbs of water (4 gallons) carried over by the air per million lbs of water (120,000 gallons) passing through the evaporative cooler media.

If the only alkali metal contamination in the inlet air comes from water entrained as the air passes through the cooler medium then the allowable concentration in the cooler water may be calculated:

$$(A)(X_a) = (W)(X_w)$$

$$W = A * (X_a/X_w) = 0.005 (A/X_w)$$

$$X_w = (X_a)(A/W)$$

W = Water carry-over from media (drift rate) lbs/sec = Water flow through cooler x carryover rate (0.0033%)

A = Mass Flow of Air through Evaporative Cooler (lbs/sec)

X_a = allowable concentration of alkali in air (ppm) = 0.005 (5 ppb)

X_w = allowable concentration of alkali in water (ppm)

Table 4 — Sample Calculation - Allowable Sodium in the Cooler Circulating Water for 7FA GT

For 7FA	A	W	X_a	X_w	
Water flow in Evap. Cooler (lbs/sec)	Gas Turbine Inlet Air Flow (lbs/sec)	Carryover (lbs/sec)	Allowed Sodium in inlet air (ppm)	Allowed Sodium in cooler water (ppm)	Allowed Sodium in cooler water with 10x margin (ppm)
28	975	0.0009185	0.005	5306	531

NOTE

The values in table 4 are representative of the 7FA gas turbine and show an example of a calculation of sodium levels. Each model turbine, and its associated evaporative cooler, will have different air and water flows, which will be found in the operating manuals.

At a laboratory measured drift rate, the maximum, calculated, allowable sodium content in the cooling water is very high, over 5,300 ppm Na+K, and at least a 10X safety factor is recommended, since in an operating evaporative cooler there may be significant nonuniformities in air velocity compared to the laboratory test conditions.

The maximum alkali metal value of 550 ppm (Na + K) in the cooler circulating water, given in Table 3, accounts for only the expected drift from the media. All splashing, leaking and other by-passing of the design air flow path must be eliminated. Incorrect installation of media and other mechanical problems in the cooler can cause very serious carryover, which could cause damage in the compressor that can only be corrected by replacement of the airfoils.

D. Protection of the Compressor

Elimination of carryover of alkali metal salts to the turbine section is only one of the two major concerns for corrosion when using an evaporative cooler. The other is prevention of corrosion in the compressor.

The levels of contaminants in the air passing through the compressor, which are necessary to cause deposits, are not known.

Analogy can be made to steam turbines which see deposition of contaminants of similar chemistry, and have similar materials of construction as the compressor and hence similar corrosion problems (9).

A limit of 3 ppb chloride ion is set for the air entering the compressor, which, with the same safety margin set for the alkali metals, gives a limit of 311 ppm, as Cl, in the cooler circulating water. This is the basis for the chloride limit given in Table 3.

VI. SUMMARY

The evaporative cooler has been in use for many years conditioning inlet air for gas turbines. The cooler is a simple machine and should give reliable, long term service. The keys to this are firstly: understanding the requirements for the recirculating water and setting up a program which produces makeup of the quality needed. Secondly, ensuring that the cooler is installed and set up correctly, so that carryover of recirculating water into the compressor does not occur.

Acknowledgement

We would like to acknowledge the support of the Munters Corp who allowed us the use of their technical bulletins in the writing of this GEK.

VII. REFERENCES

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7. GEK 107230 "Specification for Alkali Metal Contamination in Fuels for the FB and H Model Gas Turbines."
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Appendix 1 Definitions

A. Evaporative Cooler Efficiency

$$\text{Efficiency} = \frac{(\text{EDBT} - \text{LDBT})}{(\text{EDBT} - \text{WBT})} = \text{nominally } 85\%$$

Leaving Dry Bulb temperature (LDBT) can be calculated.

$$\text{LDBT} = \text{EDBT} - [(\text{Evap Cooler Eff})(\text{EDBT} - \text{WBT})]$$

B. Evaporation Rate (ER)

The amount of water evaporated in gpm as the air passes through the cooler can be approximated by the following formula.

$$\text{Evaporation} = \frac{\text{CFM (thousands)} * (\text{EDBT} - \text{LDBT})}{500}$$

C. Blowdown

Blowdown is a function of evaporation rate and the cycles of concentration. It is the flow of water which must be continuously removed from the cooler in order to maintain the chemistry of the recirculating water at the design value.

$$\text{Blowdown} = \frac{(\text{Evaporation Rate})}{(\text{Cycles} - 1)}$$

D. Makeup Water

The water added to replace that lost by evaporation and through blowdown.

$$\text{Makeup Rate} = \text{Evaporation Rate (gpm)} + \text{Blowdown Rate (gpm)}$$

NOTE

At startup of an evaporative cooler, the dry media will absorb about 0.5 lbs water per cubic foot of dry media resulting in a delay between the time that the pumps start and when water starts to return to the sump. As a result of this, at the startup of an evaporative cooler, a higher makeup rate will be required for a limited period.

E. Scaling Indices for Evaporative Coolers

These indices indicate the tendency of water to be scaling or corrosive as a function of four factors:—

- temperature
- hardness
- total alkalinity
- pH

There are three indices in use:—

Practical (Puckorius) Stability Index, Ryznar Stability Index (RSI), Langelier Saturation Index (LSI)

Methods for calculating the indices are shown in Appendix 2.

Recommended values for common indices for maintaining recirculating water systems are given in Table 2.

F. Drift (Carryover)

Water droplets which are carried over from the cooling media through the drift eliminator and are present in the airflow as it enters the compressor section of the turbine. Contaminants enter the turbine dissolved in this water.

G. Dry Bulb Temperature

The temperature as measured by a standard thermometer.

H. Wet Bulb Temperature

The temperature as measured by a thermometer which has a water moistened wick around its bulb. If the air is at a temperature above its dew point, evaporation of water will occur in the wick causing cooling and the reading of a temperature below the dry bulb temperature. At 100% humidity, the wet bulb and dry bulb temperatures are the same. The Dew Point of the air is the temperature of 100% humidity, the point at which the air is saturated with water vapor and where condensation of liquid water may occur.

Appendix 2 - Methods of Calculation

The choice of makeup water and the operation of the evaporative cooler are the responsibility of the owner. The methods of calculating the different operating parameters given here are illustrative and for guidance only. In addition to using the information in this section the operator should seek guidance, as needed, from a water treatment expert who is familiar with the water chemistry as it relates to the operation of an evaporative cooler with a GE gas turbine, and other conditions at the plant.

J. Calculation 1 - Scaling Indices

These indices indicate the scaling or corroding tendencies of water.

Table 5
Data for Rapid Calculations of Puckorius (Practical) Scaling Index for Evaporative

Conductivity		Calcium Hardness		Total Alkalinity		Alkalinity	
($\mu\text{S}/\text{cm}$)	Factor A	(PPM as CaCO_3)	Factor C	(PPM as CaCO_3)	Factor D	(PPM as CaCO_3)	Factor E (pHeq)
50–300	0.1	10–15	0.70	10–15	1.10	50	7.00
301 – 1001	0.2	16–25	0.90	16–25	1.30	100	7.50
1001– 3000	0.25	26–40	1.10	26–40	1.50	200	7.90
3000 – 5000	0.27	41 – 70	1.35	41 – 70	1.75	300	8.20
		71 – 100	1.55	71 – 100	1.90	400	8.40
Ambient Temperature	Factor B	101 – 140	1.70	101 – 140	2.10	500	8.50
F		141 – 200	1.85	141 – 200	2.25		
50 – 56	2.3	201 – 250	1.95	201 – 250	2.34		
58 – 62	2.2	251 – 300	2.05	251 – 300	2.45		
64 – 70	2.1	301 – 350	2.12	301 – 350	2.52		
72 – 80	2.0	351 – 400	2.18	351 – 400	2.58		
		401 – 450	2.24	401 – 450	2.63		
		451 – 500	2.26	451 – 500	2.68		

Method of Calculation

(1) Obtain values of A, B, C, D and E (pHeq) from Table 5

(2) $\text{pHs} = (9.3) + (A + B) - (C + D)$

(3) Puckorius (Practical) Scaling Index = $2 \text{ pHs} - \text{pHeq}$

EXAMPLE

Find the Puckorius (Practical) Scaling Index at 70°F of water, which has the following characteristics.

Conductivity = 700 $\mu\text{S}/\text{cm}$

Calcium hardness as CaCO_3 = 306 PPM,

Alkalinity as CaCO_3 = 234 PPM.

Then reading from Table 3 :

Factor A = 0.2

Factor B = 2.1

Factor C = 2.12

Factor D = 2.34

Factor E (pHeq) (based on interpolation with Alkalinity of 234 PPM) = 8.0

$$\text{pHs} = (9.3 + 0.2 + 2.1) - (2.12 + 2.35) = 7.13$$

$$\text{PSI} = (14.26) - (8.0) = 6.26$$

Based upon Table 1, the water is neutral - not scaling or corrosive.

K. Calculating Other Scaling Indices

Table 5 can also be used to calculate the Langelier and Ryznar indices as follows:

(1) Use the actual pH of the water in place of pHeq.

(2) Calculate the pHs using Table 5.

$$\text{Ryznar (RSI)} = 2 \text{ pHs} - \text{pH}$$

$$\text{Langelier (LSI)} = \text{pH} - \text{pHs}$$

L. Evaluation of a Water Supply for Use in an Evaporative Cooler

Prior to the commissioning of a new evaporative cooler, either in a new plant or as an add-on to an existing plant, the sources of water available for the makeup supply must be evaluated.

To allow a complete pre-operational evaluation, all the constituents of the water, which are listed in Table 3 and 5, must be provided.

Since the water will be used as a makeup source to the circulating water in the evaporative cooler, and not as a once through supply, its chemical properties after a number of cycles of concentration must be calculated or predicted. This is essential so that the can be estimated at the design operating conditions of the cooler. One important economic criterion is whether the water will perform satisfactorily at a minimum of two cycles of concentration.

M. Calculation 2 - Effect of Cycles of Concentration on the Scaling Index

A supply of water, with the parameters in the column of Table 2 headed "Makeup" is evaluated for the cycles of concentration that it could accept.

Simple multiplication by the concentrating factor (2, 3, 6 or 8) gives the values of the parameters at different cycles of concentration except for the alkalinity and the pH.

For Alkalinity, multiply by 0.67x (2, 3, 6 or 8).

For pH

$$14 - \text{pH} = \text{p}[\text{OH}]$$

$$10^{(\text{pOH})} = \text{OH concentration}$$

multiply [OH] by cycles of concentration

take base 10 log of [OH]

$$\text{pH} = 14 - \text{p}[\text{OH}]$$

Using the procedure described above in Calculation 1 the effect of different cycles on the values for PSI were obtained and are shown in Table 6.

It can be seen that the hardness and scaling index are more limiting on cycles than the limits for chloride, sodium or conductivity and that the operating limit to be planned for is 5.5 cycles.

Table 6
Evaluation of Effects of Cycles of Concentration

Cycles of Concentration							
Parameter	Make-up	X2	x3	x6	x8	Parameter limit from Table 3	Allowed cycles
pH	8.24	8.54	8.72	9.02	9.14		
Alkalinity	65	87.1	130.6	261	348	500	7.7
Cl	52	104	156	312	416	300	5.8
Hardness	91	182	273	546	728	500	5.5
Ca	25	50	75	150	200		
Mg	6	12	18	36	48		
TDS	182	364	546	1092	1456		
Na	34.7	69.4	104.1	208	277	550	15.9
Conductivity	367	728	1101	2202	2936	5000	13.6
PSI	9.30	8.34	7.35	5.87	5.30	6.5 +/-0.5	5.5

If the pH of the sump needs to be adjusted in order to give an acceptable scaling index this can be done by adding acid (sulfuric or hydrochloric) to reduce pH or by adding base (sodium hydroxide) to increase pH.

The evaluation of the makeup and circulating water and changes to chemical parameters such as pH should be done along with your water treatment engineer.

Appendix 3 - Sump and Makeup Water Sampling Plan

A. Water Sampling and Analysis Plan

GE's requirements for makeup and circulating water chemistries for evaporative coolers in use with gas turbines are given in Table 3. The sump and makeup waters should be sampled with sufficient frequency that the condition of the water in the evaporative cooler is known at all times.

The operator should confirm that the water samples for the site have been taken and analyzed and that the conductivity settings to control blowdown have been determined in accordance with the requirements of the latest revision to the GE Water Quality GEK 107158.

The scaling index for the sump water should be checked weekly for the first year and at least monthly thereafter. Accordingly, the parameters required to obtain scaling index, pH, alkalinity and hardness must be measured at least weekly. It is recommended that the data be trended since the chemistry of the sump and makeup waters may change seasonally.

Once the operation of the evaporative cooler has been established, many of the parameters need only be measured at startup, during troubleshooting of a problem or when a new source of makeup water is qualified.

The methods for testing are shown in Table 7.

Table 7
Test Methods for Water Analysis.

PARAMETER	ASTM Test Method
P and M Alkalinity, as CaCO_3	D 1067-92
Specific Conductivity	D 1125-95
Suspended Solids	D 5907-96a
Total Hardness, as CaCO_3	D 1126-96
pH	D 1293-95
Oil and Grease	D 3921-96
Sodium, Na	D 4191-93
Potassium, K	D 4192-93
Ammonium, NH_4	D 1426-93
Calcium, Ca	D 511-93
Magnesium, Mg	D 511-93
Silica, SiO_2	D 859-94
Iron, Fe	D 1068-96
Chloride, Cl	D 512-89
Sulfate, SO_4	D 516-90
Heavy metals, (Mn, Cu, V, Pb)	D 1976-96
Zinc, Zn	D 1691-95

B. Sampling and Testing During Initial Operation

Sample and analyze the sump makeup water and verify compliance with Table 3. Repeat make up water analysis twice per month for the first year of operation and determine a proper sampling period for the future.

1. Sampling the sump

Take the water sample from the sump when the automatic blowdown starts to direct water to the drain. Analyze this water sample to assure that all the recirculating water requirements are met and that the conductivity of the water matches the conductivity setting to initiate blowdown. Adjust the conductivity setting for blowdown as required to optimize the sump water makeup concentrations to assure that all the sump water requirements identified in Table 3 are met and to maximize the life of the evaporative cooler media as it relates to scaling and scale dissolving. Repeat this procedure until the optimal conductivity setting is identified. The turbine control system is set so that blowdown from the sump of the evaporative cooler is initiated at 1000 $\mu\text{S}/\text{cm}$ and continued until a value of 800 $\mu\text{S}/\text{cm}$ is reached.

2. Sample the evaporative cooler sump water chemistry parameters given below quality on a daily basis for the first 3 months of operation :

- Conductivity (convert to TDS by multiplying by 0.6)
- Alkalinity
- Calcium Hardness
- pH

From these parameters the Scaling Index can be calculated.

During the time that the sampling is taking place, document the following:

- time of day,
- ambient temperature, and the
- ambient relative humidity.

Verify that all the recirculating water requirements are met. Confirm that the conductivity of the sump water sample matches the conductivity of the sump water identified at the turbine control system at the time of sampling.

Also, based on the measured conductivity, ensure that this value, and the time which the sump has been blowing down, are consistent with the control value which has been set to initiate blowdown.

During startup, the turbine control system is set so that blowdown from the sump of the evaporative cooler is initiated at 1000 $\mu\text{S}/\text{cm}$ and continued until a value of 800 $\mu\text{S}/\text{cm}$ is reached. When the cooler system is operational and sump water testing has been established, a different conductivity value and blowdown time may be specified on a custom basis for the system.

3. During the first 3 months of operation, sample the sump and adjust conductivity set points as described in B.1 a minimum of once per week.
4. Following the first 3 months of operation, repeat B.1 a minimum of twice per month for the first year of operation. Following the first year of operation, repeat step B.1 on a regular interval that is based on the available test data.
5. Following the initial months of operation, using the available data, generate a water sampling / testing plan that is appropriate. Suggested parameters to be tested, and a frequency of testing are given in Table 8.

Table 8

Sample Frequency	Weekly		Monthly		Qualify and Trouble Shoot	
PARAMETER	Sump	Makeup	Sump	Makeup	Sump	Makeup
P and M Alkalinity, as CaCO ₃ (ppm)	X			X		
Specific Conductivity, μ S/cm	X	X				
Suspended Solids, g/l	X					X
Total Hardness, ppm as CaCO ₃	X	X				
pH	X	X				
Oil and Grease, (ppm)					X	X
Sodium, Na (ppm)			X	X		
Potassium, K (ppm)					X	X
Ammonium, NH ₄ (ppm)					X	X
Calcium, Ca (ppm)			X	X		
Magnesium, Mg (ppm)			X	X		
Silica, SiO ₂ (ppm)			X	X		
Iron, Fe (ppm)			X	X		
Chloride, Cl (ppm)			X	X		
Sulfate, SO ₄ (ppm)			X	X		
Heavy metals, (Fe, Mn, Cu, V, Pb),(ppm)					X	X
Zinc, Zn (ppm)					X	X



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Attachment 17 GE 2008 Field Service Rates

(See Attached)

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GE Energy's aeroderivative group Global Field Services is a world-class service and support network designed to anticipate and respond to our customers needs throughout the product life of GE LM engines and packages. The worldwide team supplies the highest quality parts, tools and technical support which is closely tied to our Service Engineering teams. This may result in higher availability and lower costs for you, the customer. Please contact your Service Manager for any of your service needs, 24 hours a day, seven days a week.

Region

Asia
Northern Europe
Central Europe
Southern Europe
Middle East
Eastern USA/Canada
Central USA
Western USA/Canada

Location

Singapore
Lincoln, UK
Rheden, NL
Madrid, Spain
Istanbul, Turkey
Syracuse, NY
Houston, TX
Bakersfield, CA

Offerings

GE Energy's aeroderivative group Global Field Services is dedicated to responding to your needs in an expedient manner. Aero Energy Field Service should help minimize your downtime and provide a lower cost operation by providing full technical coverage for your engine and package. Our services include but are not limited to: Periodic Inspections of the engine and package, Hot Sections, Generator Test and Inspection, Trim Balances, Vibration Surveys, Performance Testing, Controls Calibration, and all Level 1 & 2 Maintenance.

In response to our customers' requests for flexibility in commercial offerings, GE Energy's aeroderivative group Global Field Services now provides the option for Firm Fixed Pricing on many work scopes.

Technical Assistance

Rate Classification	Labor Rate Per Hour		Incremental Charges		
	Straight Time	Overtime	High Security Areas	Emergency Call-Out	Offshore/Man Camps
Field Representative	\$195.00	\$292.50	20%	10%	20%
Specialty Field Rep	\$250.00	\$375.00	20%	10%	20%
Site Manager	\$270.00	\$405.00	20%	10%	20%
Project Engineer	\$270.00	\$405.00	20%	10%	20%
Mobilization Fee	\$375.00				

All charges are USD/HR

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GE Energy's aeroderivative group Global Field Services provides multiple levels of technical support as follows:

Field Service Representative

Perform the maintenance action as well as provide technical advice based on good engineering, manufacturing, installation and operation practices applicable to the equipment. Such services also include testing, adjustment, and installation and start-up. Field Engineering Service does not include supervision of Purchaser's agents or other contractors.

Specialty Field Representative

May be any of the following:

- Gas Turbine DLE: Specialist skilled in methods required for adjusting the Dry Low Nox system to optimize gas turbine emissions and life expectancy of combustion system components.
- Laser Alignment: Specialists utilizing GE proprietary digital laser alignment equipment, technology, and fleet data, to optimize internal component alignment and potentially provide significant reductions in outage duration over conventional alignment methods.
- Trim Balance/Blade Change: Specialists utilizing GE proprietary software and equipment to lower the possibility of an engine imbalance.
- Programming and Controls
- Boro-blend: Specialists trained at blending damage to the HPC/LPC blades through the borescope ports.
- Excitation: Specialists skilled in the start-up and troubleshooting of excitation systems interfacing circuits, breakers, and power systems.
- Professional Witness: Technical coordination and witness of performance tests not conducted by GE.
- Vibration: Specialists experienced in vibration data acquisition, vibration machinery diagnostics, rotor balance analysis, and recommendations on installation of balance weights.

- Emergent Technology: Specialists skilled in an area involving new technology that is not specifically covered by the specialist categories listed.
- Consulting Analyst: Technical assistance of personnel not normally classified as field personnel for the solution of problems that require highly specialized background and experience.
- Diagnostics: Specialists skilled in performance diagnostic tests data analysis, such as plant evaluations, equipment, performance services and general consulting for plant performance issues.

Project Manager

Manages all aspects of major upgrades.

Notes:

Applicable Rates:

The normal workweek is five consecutive eight-hour days (typical to specific countries, contact your local Regional Field Service Office). Time in excess of the normal workweek will be billed at the overtime rate.

Minimum Charge

A minimum charge of 8 hours straight time plus per diem and travel expense is charged for any service job. Offshore vessels or rigs and work in isolated areas with man-camps will be charged a minimum 12 hours per day.

Mobilization Fee

Mobilization fee consists of basic job preparation including but not limited to: normal risk assessments or method statements; environmental, health and safety preparation; tooling and resource coordination and restocking. This fee is invoiced on a per dispatch basis in the amount of \$375 USD.

Waiting Time

If the Field Service Technician is requested to wait at the site location, waiting time will be charged at minimum 8 hours per day (standard rates, including weekend days). If the customer does not request the technician to wait, no charges will be due, the technician will not be available to work and, the technician is considered unassigned and free to be assigned to other projects. Waiting time on offshore floating vessels, stationary rigs, and at isolated sites with man-camp living facilities will be charged a minimum 12 hours per day including weekend days.



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Working Hours

Individual maximum working hours are 12 hours per day not to exceed 84 hrs per fiscal week. Exceptions to the maximum 12 hour workday must be agreed to PRIOR to work commencing with the local Regional Field Service Office up to a maximum of 16 hours per day per individual (followed by an appropriate 10 hour rest cycle) but not to exceed 84 hours per week. Unless otherwise contracted, working hours do not include the following: lunch or daily travel less than 30 minutes per leg between lodging and work location. Contact your local Regional Field Service Office for further clarification. In situations where local regulations or customer policies exist regarding on-duty limitations, the more conservative procedure shall take precedence.

Transportation Expenses

All transportation (i.e., mileage, airfare, train, taxi, ferry, rental car, etc.) expenses for each dispatch are invoiced at Cost +15%. Mileage will be invoiced at \$1.05 USD/mile when technicians travel to customer site via automobile.

Living Expenses

Per Diem will be billed for any portion of a day worked including travel days. This daily charge is for normal daily expenses such as lodging, meals, laundry, normal communication expenses, fuel for rental car, and reasonable road tolls for all days. Any other daily expenses will be invoiced at Cost +15%.

- Regular per diem, \$230 per day per employee
- High cost per diem (Applies when lodging cost is more than \$130 per night, including taxes/per person), \$300 per day per employee

Holidays

Holidays are country specific and overtime rates are applicable. A holiday schedule for each country can be provided upon request.

High Security Area

A region deemed to have a substantial level of security risk inherent with the location (GE group 1 & 2 countries) will be assessed a minimum 20% Security fee on all labor hours.

Emergency Call-out:

Dispatch with less than 48 hours notice will be assessed a 10% Emergency Call-out fee on labor hours only.

Offshore & Man Camps

Any labor for work sites located on offshore floating vessels, stationary rigs or in isolated areas with man-camp living facilities, will be assessed a 20% fee for all hours on site.

Purchased Materials & Contracted Services:

Will be billed at cost plus 25%.

Tooling Rental fees

GE rents level 1 and level 2 special tools at competitive rates. These tools are available through your respective Service Manager. Tooling pricing is based on work scope as listed in tooling rental table. Listed price provides special tooling to complete contracted scope of work for the normal maintenance duration. Tooling required on site beyond the normal duration of the contracted scope of work will be assessed a daily fee. A GE Technical Representative must accompany all rentals of GE tooling assets. Tooling is not rented separately for direct customer use.

Shipping Fees

All customs, duties and handling fees incurred by GE in the process of importing or exporting tooling or goods on behalf of the customer, including excess baggage and customs duties for hand carried items, will be invoiced at Cost +15% handling fee.

Terms and Conditions

Customer Service Support is subject to standard terms and conditions - GE Form APS 33D.

Effectivity

These prices supersede all previously published prices for this same service. The prices of additional or newly established service will be available on a quotation basis and may be subject to revision until such time as they are incorporated into the next issue of this price sheet. The prices indicated are list unit prices and are subject to change without notice.



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Tool Rental Pricing

Catalog Workscope	Description	Normal Scope Rate	Daily Rate	
APS_FS_HS-LM60-LMS	LM6000/LMS100 Hot Section Workscope Tooling	\$26,080	\$6,520	
APS_FS_HS-LM25-50	LM2500/5000 Hot Section Workscope Tooling	\$12,630	\$4,210	
APS_FS_HS-LM5-15-16	LM500/1500/1600 Hot Section Workscope Tooling	\$7,830	\$2,610	
APS_FS_ENG-PTXCHNG	Engine or PT Exchange Workscope Tooling	\$4,350	\$1,450	
APS_FS_INSP-SEMI	Semi Annual Package Inspection Tooling	\$1,480	\$1,480	
APS_FS_INSP-ANNUAL	Annual Package Inspection Tooling	\$2,970	\$1,480	
APS_FS_GEN-MINOR	Generator Minor Inspection Tooling	\$2,670	\$670	
APS_FS_GEN-MAJOR	Generator Major Inspection Tooling	\$12,350	\$2,060	
APS_FS_TOOL-SPC	Special Package Tooling Work Packages - PTK, FTK, ADRE, Emission, etc.	\$2,000	\$670	
APS_FS_TOOL-STND	Standard Package Tooling Work Packages - Shaker, O-Scope, precision, Impact, etc.	\$670	\$330	
APS_FS_TOOL-MINR	Minor Package Tooling Work Packages - Fanuc, Genius, etc.	\$60	\$60	
APS_FS_LPC	Low Pressure Compressor Workscope Tooling	\$4,730	\$1,580	
APS_FS_TMF	Turbine Mid Frame Workscope Tooling	\$4,730	\$1,580	
APS_FS_HPC	High Pressure Compressor Workscope Tooling	\$1,580	\$1,580	
APS_FS_BSI-BLEND	Borescope or Boreblend Tooling	n/a	\$670	
APS_FS_ENG-LVL1	Level 1 work package tooling / per	n/a	\$130	
APS_FS_TOOL-OTHER	Other as quoted	n/a	n/a	
APS_FS_SB220	Includes Engine Exchange + LPC + SB220	\$13,800	\$4,730	
APS_FS_Flush	Oil System Flush (Turbine or Generator)	\$3,220	\$460	
APS_FS_LMS_CONEX	LMS100 I&C Tool Conex	\$25,000 /monthly rate	\$5,770	n/a

