1.0 Package Scope of Supply

1.1 Gas Turbine

The 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.

1.2 Generator

Open air cooled, 2-pole generator operating at 13.8kV, 60 Hz. Generator is capable of handling customer power requirement throughout a wide ambient temperature range. The generator includes a brushless excitation system with permanent magnet generator. Neutral and line side cubicles are included.

1.3 Unit Enclosure

The package is supplied with weatherproof, acoustic enclosures. The enclosures are designed to achieve noise abatement to an average of 85 dB(A) at 3 ft. (1.0 m) away and 5 ft. (1.5 m) above grade during full load operations. The enclosures are completely assembled and mounted over the equipment prior to testing and shipment. Both turbine and generator compartments are fully ventilated with redundant fans (one running, one stand-by). Explosion-proof lighting is provided in both compartments.

1.4 Gas Turbine / Generator Baseplate

The 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 (IBC2000) as well as providing a convenient structure for transportation.

1.5 Air Inlet System

The 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. Filtered air is silenced before entering the turbine plenum. This design results in a compact arrangement and eliminates the need for customer 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.

The inlet system will also be equipped with a heating system to bring the air up to the correct temperature.

1.6 Turbine Exhaust

The 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.

1.7 Simple Cycle Exhaust Stacks

Each package includes one (1) Simple Cycle Exhaust Stack. The Exhaust Stack is rated at 85 dBA sound pressure at one (1) meter.

1.8 SPRINT® Power Augmentation

SPRINT® boosts engine performance using a spray intercooling design that 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. Unit requires 22 gpm (83 lpm) of demineralized water to the connection on the unit. Water must meet GE specification MID-TD-0000-3.

1.9 Gas Fuel System

The package is supplied with a natural gas fuel system that utilizes an electronically controlled fuel-metering valve. For full-load operation, the gaseous fuel must be supplied to the baseplate at 675 psig±20 (4,654 ±138 kPag). Gas fuel must meet GE specification MID-TD-0000-1.

1.10 Water Injection System

The Water Injection System serves to control the amount of oxides of nitrogen (NOx) emitted by the gas turbine engine during normal operation. Demineralized water is injected into the combustor section of the gas turbine through the fuel nozzles on the engine. Demineralized water from a customer source is pressurized by the water injection pump and plumbed into the main skid.

The Water Injection System contains the following major components. They are mounted on the water filter skid, water injection pump skid and main skid.

- Duplex low pressure filter upstream of pump skid
- Water injection pumps (High Pressure and Low Pressure)
- Flow transmitter
- Flow metering valve

1.11 Lube Oil Systems

The package is supplied with two separate lube oil systems: one synthetic for the gas turbine and one mineral for the generator. The oil reservoirs and piping are all stainless steel, and the lube oil system valves have stainless steel trim. The turbine coolers, oil reservoir, and filters are mounted on the auxiliary equipment module. The mineral lube coolers, reservoir and filters are located on the main skid baseplate. The auxiliary equipment module provides simplified piping connections and reduces customer's installation time and costs.

1.12 Electro-Hydraulic Start System

The 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.

1.13 Fire Protection System

The package is supplied with a fire protection system complete with optical flame detection, hydrocarbon sensing and thermal detectors, piping and nozzles in both the generator and the turbine compartments. The fire protection system includes cylinders containing CO2 mounted on a separate skid. A 24V 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, 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.

1.14 Control System

The control system includes vibration monitoring, digital meter, digital generator protective relay module and an HMI (human machine interface) display of key discrete and analog data. Alarm and shutdown events are displayed on the HMI automatically. 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.

1.15 Generator Protective Relays

The package is supplied with a microprocessor-based generator protective relay module, mounted in the Turbine Control Panel. The protective relay system includes functions are necessary for protection of the generator.

1.16 Soak Wash System

The package is supplied with a turbine cleaning system, which allows customers 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 purified water at a maximum of 50 psig (345 kPag) and air at 100 – 120 psig (689 – 827 kPag).

2.0 Typical Engine Refurbishment

The overhaul/refurbishment process is typically based on the borescope inspection of each LM6000 CTG in conjunction with the total engine hours, the factored fired hours since the last repair and/or overhaul, and other applicable engine history. The following scope is planned for execution in order to return the engine to operations for this specific project:

General Engine Refurbishment Process:

1. Receive CTG into Depot and Disassemble into Engine Modular Units
   - Incoming inspection and photograph of CTG arrival
   - Report of missing and damaged external hardware
   - Disassemble into Engine Modular Units, clean, and inspect as required
     - Low Pressure Compressor
     - High Pressure Compressor
     - Combustor Module
     - High Pressure Turbine
     - Low Pressure Turbine

2. Condition Based Overhaul of Accessories and SB Implementation
   - Lube and Scavenge pump with applicable SB implementation
   - Hydraulic Control Unit, Variable Geometry pump, and Starter Motor
   - Engine actuators and implement applicable SB

3. Condition Based Bearing Overhaul or Replacement with new including Associated Work and SB implementation
   - Disassembly of the Compressor Front Frame, Compressor Rear Frame, Turbine Rear Frame, Accessory Gear Box, and Inlet Gear Box
   - Overhaul or Replacement with new of all engine bearings
   - As required overhaul of cold end Teflon seals (# 1 bearing and # 3 bearing)
   - Inspect, clean and as required re-coat of Air Collector
   - Implement all applicable SB's
   - Reassembly with new consumables
   - Inspect and as required overhaul of #1 Bearing Stationary air seal or replacement with new condition

4. Inlet Guide Vane (IGV), Low Pressure Compressor Rotor (LPCR), and Low Pressure Compressor Stator (LPCS) Repair
   - Condition based IGV disassembly, strip, and recoat
   - Condition based LPCR disassembly and disk/shaft overhaul
   - Condition based LPCS disassembly and stage 3 shroud overhaul
   - Labor and consumables to reassemble the IGV and LPC

5. Hot Section Overhaul
   - Condition based overhaul of all airfoils, stage 1 and 2 blades and nozzles or Replacement with New Chromalloy Single Crystal Extended Life hardware
   - Condition based Overhaul of HPT stage one and two shrouds or replacement with new or OH
   - Applicable SB implementation

6. Overhaul of the Combustion Chamber
   - Condition based overhaul of Single-annular Combustor (SAC)

7. Clean, flow check and as needed overhaul of all 30 Fuel Nozzles
   - Clean, flow and recertify 30 Fuel Nozzles

8. HPC repair and SB implementation
   - As required Overhaul of HPC Rotor spools and Stator cases
   - As required Overhaul of all damaged blades and vanes or Replacement with new or Serviceable condition hardware
   - Applicable SB implementation

9. Assembly of the engine
   - Labor and consumables required to reassemble engine
   - Applicable SB implementation

10. As Required Acceptance Test of Completed Engine

Typical SB Implementation for LM6000 Overhaul					
Service Bulletin No.	**Title**	**Compliance Category**	**Compliance Level**	**Issue Date**	**Module**
125	Balance Piston Replacement	C	F/D	25-Aug-99	LPT
128	No. 4 Bearing Rotating Air, Seal Inspection	C	D	12-Sep-07	HPC
148	Introduction of Improved, No. 1 Bearing Stationary and Rotating Air/Oil Seals	C	F/D	28-Jun-02	LPC
165	Safety-Wire LPT Rotor, XNSD Electrical Connector	C	F	15-Jan-02	LPT
172	Introduction of Improved Inlet Gearbox Spanner Nut	C	D	21-Aug-01	IGB
178	Lube and Scavenge Oil Manifold Nipple Replacement	C	F	30-Jan-02	GTA
181	Variable Bypass Valve Actuating Ring Bolt Inspection and Re-torque	C	F	25-Jul-02	CFF
202	Acoustic Sensor (Pressure Transducer) Adapter Replacement	C	F	18-Mar-04	GTA
203	Stg 5 VSV Lever Arm Improvement - High Boss Stator	O	F/D	12-Apr-04	HPC
212	LPC Stg 3 Bushings Replacement	R	F	2-Aug-04	LPC
213	HPC Stator Stg 3-5 VSV Bushings Replacement	C	F	4-Dec-06	HPC
220	Introduction of Inlet Gearbox Assembly PN 9185M71G31	C	D	17-Sep-07	IGB
229	Stage 3 through 5 High Pressure Compressor Rotor Blades	C	F/D	25-Jan-07	HPC
232	PX 36 Sensor Electrical connection Relocation	R	F/D	21-Sep-07	GTA
237	VBV Clevis Bolt Length Increase	R	F/D	4-Aug-04	CFF
239	Improved LPT Coupling Nut	C	F/D	29-Jan-09	LPT
240	Improved Forward Fan Shaft Coupling Nut	C	F/D	29-Jan-09	LPC