

# TECHNICAL SCOPE DOCUMENT

Presented To:

**Electricidad de Caracas**

For

## **The Turnkey Installation of Two (2) LM6000 PC GTG's & Balance of Plant at Tacoa**

*By*



Proposal No. T9003B  
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EDC**

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## **Section 1.0 Introduction**

EDC desires to build a 100 MW gas fueled generating facility installed and operational within the schedule agreed upon. ProEnergy EPC Services proposes to install (2) Owner Finished GE LM6000 Sprint Gas Turbine Generators including additional auxiliary and balance of plant equipment as described in Sections 2 & 3.

In addition to installing the Owner furnished equipment, Contractor will also be supplying and installing other balance of plant equipment as described in Sections 2&3.

The LM6000 generator packages will be either New Surplus or Used Refurbished.

Associated with this proposal is **ProEnergy's O&M Services proposal**.

**THIS DOCUMENT IS CONFIDENTIAL. IT IS DESIGNED AND INTENDED FOR ELECTRICIDAD DE CARACAS' USE. THIS DOCUMENT IS FOR THE SOLE PURPOSE OF EVALUATING PROENERGY EPC SERVICES' PROPOSAL FOR THE LM6000 POWER PLANT.**

## Section 2.0 Scope of Work and Supply

The Scope of Work and Supply is comprised of the following outlined items:

### **Major Generation Equipment**

Installation of two (2) Owner Supplied GE LM6000 gas turbine generator packages, (one (1) LM6000 PC and one (1) LM6000 PD), complete with auxiliary skids, inlet filter and the one (1) Modular Control Building which is required with Turbine Control Panels, Generator Control Panels, GTG MCC, 24 VDC Batteries and Chargers and 125VDC Batteries and Charger.

GE Package interface points are as follows:

Equipment System	Limits of GE Package
<ul style="list-style-type: none"> <li>All supply piping, including Fuel Gas, Cooling Water, Demineralized Water, Lube Oil, Compressed Air, Instrument Air, Hydraulic Start Oil</li> </ul>	<ul style="list-style-type: none"> <li>Flanged or threaded connection on GE Package base plates.</li> </ul>
<ul style="list-style-type: none"> <li>Inlet Air-to-Filter</li> </ul>	<ul style="list-style-type: none"> <li>Atmosphere</li> </ul>
<ul style="list-style-type: none"> <li>Turbine/Generator Ventilation Air</li> </ul>	<ul style="list-style-type: none"> <li>Atmosphere</li> </ul>
<ul style="list-style-type: none"> <li>Turbine Exhaust</li> </ul>	<ul style="list-style-type: none"> <li>Flange &amp; Expansion Joint for connection to Exhaust Stack</li> </ul>
<ul style="list-style-type: none"> <li>Instruments on GE Package Base plate</li> </ul>	<ul style="list-style-type: none"> <li>Terminal box on base plate</li> </ul>
<ul style="list-style-type: none"> <li>Instrument wiring in Turbine Control Panel</li> </ul>	<ul style="list-style-type: none"> <li>Terminal in Turbine Control Panel</li> </ul>
<ul style="list-style-type: none"> <li>High Voltage Connections</li> </ul>	<ul style="list-style-type: none"> <li>Bus bar in GE Package generator line side cubicle</li> </ul>
<ul style="list-style-type: none"> <li>Generator Ground Connections</li> </ul>	<ul style="list-style-type: none"> <li>GE Package Neutral cubicle</li> </ul>
<ul style="list-style-type: none"> <li>Electric Motors</li> </ul>	<ul style="list-style-type: none"> <li>Terminal box on individual motors</li> </ul>
<ul style="list-style-type: none"> <li>Ladders and Platforms for Air Filter</li> </ul>	<ul style="list-style-type: none"> <li>Ladders and Platforms for Inlet Air Filter and Vent Fans</li> </ul>

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## **2.0 Balance of Plant**

The contractor will design and install the facility as described in the following sections of this document. The design will include the necessary Structural, Mechanical, Electrical, Instrumentation, and Control System to install the above Major Equipment.

The Balance of Plant scope of supply will be comprised of the following:

- Contractor will provide complete design of the facility including civil, structural, buildings, mechanical, electrical, instrumentation and control system.
- Contractor will provide concrete foundations, plant gravel, fencing and security gate.
- Owner will provide the existing site at the Arrecife location which Contractor has visited and based its site layout on .
- Owner will provide access roads to the site.
- Contractor will provide Installation of the complete Power Plant with the inter-ties as described later in this document and including:
  - Mechanical installation of the various items of equipment with the associated inter-ties of raw water, demin water, firewater, natural gas and waste oil & water.
  - Electrical installation of the plant including feeds to 2 ea existing GSU Transformers, area lighting, grounding, lightning protection, and cathodic protection.
  - Installation of Instrumentation and Control System including plant instrumentation, metering, and Plant DCS.

### **2.1 BOP Major Mechanical Systems**

#### **2.1.1 Simple Cycle Exhaust Stack**

The Contractor will supply and install the exhaust stacks in accordance with the standards set out by GE for each LM6000 machine.

#### **2.1.2 Plant Fuel Gas System**

The Contractor will install the plant fuel gas system outlined as follows:

- Interconnect to Owner gas metering station above ground at gas regulating station adjacent to the Arrecife Power House.
- Install two (2) redundant coalescing filter separators on a common skid including redundant pressure regulators.
- Install a fuel gas compression plant to raise the available supply pressure of 230 psi. to the required 700 psi. for the gas turbines including sound attenuation for the (3) three compressors.
- Furnish and Install all plant fuel gas carbon steel piping, valves and fittings from plant inlet fuel gas interconnect to the fuel gas compressors and to each gas turbine fuel gas regulator filter.
- Provide and install stainless steel piping from the fuel gas filter to the gas turbine generator.

- Each supply line to the LM6000 turbines will have a gas meter with totalizer.
- Each LM6000 package is equipped with gas detectors.
- Signals to monitor and control the gas pressure are taken to the LM6000 central control room.

### **2.1.3 Plant Liquid Fuel System – Not Provided**

### **2.1.4 Water and Demineralized Water System**

Contractor will install a final water filtration system including EDI to treat the Owner furnished Demineralized water supply and sized to provide demin water to the LM6000 Plant.

### **2.1.5 Chiller System (Optional)**

Standard Chiller System – Contractor to furnish and install one (1) packaged 4,000 ton electric chiller system to supply chilled water to the two LM6000 GTG's. The design basis for the chiller system is based on ASHRAE 0.4% level for the area of 96°F dry bulb and 78°F wet bulb. The calculated chiller level is 1,896 tons for each turbine for a total of 3,792 tons. Note: This Chiller system would add an approximate 20 MW net power to the output of the plant at high ambient conditions.

- The chiller system will include:
  - 4,000 ton packaged Trane chillers
  - Galvanized Steel Cooling tower with UV resistant PVC
  - Cooling water circulating pumps
  - Chilled water circulating pumps
  - Complete electrical system including MCC's and interconnecting wiring.
  - Complete PLC based control system
  - Chemical injection skid for cooling tower
  - Insulated interconnecting piping between the chiller package and each GTG.

### **2.1.6 Oily Water Drain System**

The Contractor will furnish and install the oily water drain system as follows:

- Furnish and install below ground one (1) oily water separator with associated pumps and ancillaries.
- Furnish and install PVC or HDPE below ground piping and fittings from concrete oil containment units located at:
  - 1) All Transformers
  - 2) Gas Turbine Generator Auxiliary Skids
  - 3) Fuel Gas Compressors

Piping is to be routed to the oily water separator and then to the waste oil storage tank. The waste water is to be routed to the existing Plant Waste Water System. The Contractor will make provisions to pump the waste oil to the existing waste oil tank at the Arrecife Power House.

### **2.1.7 Plant Fire Water System**

The Contractor will furnish and install the Firewater System to be connected to the existing Main Plant Firewater System.

- Headers routed throughout the plant in accordance with NFPA Codes sized as 8" HDPE pipe.
- Monitors and Hydrants installed in accordance with NFPA Codes
- Portable fire extinguishers
- Building Fire Protection in accordance with Local Codes

### **2.1.8 Instrument and Service Air Systems**

The instrument and service air systems will be as follows:

- Contractor will install one (1) set of two (2) instrument and service air screw compressors with associated dryer and air storage tanks.
- Furnish and install stainless steel tubing with Swagelok fittings, valves, and instruments for instrument and service air systems from the air compressors to various required areas throughout plant for instrument air and service air. Furnish the appropriate quick connect connectors.

## **2.2 BOP Electrical Systems**

### **2.2.1 13.8 KV System**

The Contractor will perform the following work on the 13.8 KV system:

- Install two (2) 13.8 KV 3,000 amp generator circuit breakers with PTs and CTs, two (2) 13.8 KV Fused Disconnect switches for Aux. Power.
- Furnish and install all 13.8 KV cabling, bus work, duct bank, or hot dipped galvanized cable tray etc. from the generators to the generator circuit breakers and from generator breakers to the two Owner 69KV GSU Transformers.

### **2.2.2 13.8/4.16 KV System**

The Contractor to provide the following:

- Furnish and install one (1) 13.8KV / 4160V, 2000Kva auxiliary power transformer.
- Furnish and install one (1) 4160 V MCC to supply power to Gas Compressors

### **2.2.3 480V System**

The Contractor will provide the 480V system as follows:

- Install One (1) Owner Furnished 13.8KV / 480 volt 2.3 MVA auxiliary power transformer.
- Supply and install (1) 13.8 KV / 480 volt 2.0 MVA auxiliary power transformer.
- Furnish and install one (1) BOP 480V MCC
- Furnish and install cable tray / conduit with cabling from transformers to MCCs and from MCCs to plant 480V equipment and motors.
- Furnish and install underground conduit, duct banks, or overhead cable tray mounted on the pipe racks.

### **2.2.4 120/240 System**

The Contractor will provide the 120/240 system as follows:

- Furnish and install 480V/120/240V transformers, distribution panels and lighting panels as required with associated conduits, fittings and wire.

### **2.2.5 Plant Area Lighting**

The Contractor will provide the plant area lighting as follows:

- Furnish and install area lighting consisting of four (4) 25 ft galvanized metal poles with two (2) 400 watt metal halide floodlights on each pole sufficient to illuminate both GTG's and common areas.
- The lighting system will be connected to the black start generator
- 120 v power outlets will be furnished

### **2.2.6 Ground Grid**

The Contractor will provide the ground grid for the plant as follows:

- Contractor to tie the new ground grid into the existing utility ground grid.

### **2.2.7 Plant Electrical Cable Tray**

The Contractor will provide the plant electrical cable tray work as follows:

- Furnish and install hot dipped galvanized cable trays throughout plant. Cable trays to be mounted on pipe racks, cable trenches or within buildings for routing plant cabling. A separate cable tray will be installed for each of the 15/5 KV systems, 480V system, and instrumentation system cables.



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### **2.2.8 Underground Conduit and Cable Systems**

The Contractor will provide the plant underground conduit and cable system as follows:

- Furnish and install rigid galvanized conduit or PVC encased in concrete for all underground power, control and instrumentation systems.

### **2.2.9 Lightning Protection**

The Contractor will provide lightning protection as follows:

- Furnish and install lightning protection on each gas turbine exhaust stack.

### **2.2.10 Batteries / Chargers / UPS Systems**

The Contractor will perform the following work on the batteries / chargers / UPS systems:

- Furnish and install BOP UPS system for DCS remote PLC associated equipment.

Note: 24 VDC batteries and chargers are to be supplied as part of the GE packaged control house.

## **2.3 Plant Instrument and Control Systems**

### **2.3.1 BOP Control System**

The Contractor will furnish and install a BOP control system to be located in the Central Control Room and consisting of:

- One (1) PLC DCS system sized for LM6000 and LM2500 Plants
- Three (3) PCs for human-machine interface (HMI).
- Two (2) printers.
- One (1) software package for plant DCS.

### **2.3.2 Plant Instrumentation Devices**

- Contractor to furnish and install instrument devices, both pneumatic and electric, consisting of meters, pressure, flow, temperature and level where required.

### **2.3.3 Electronic Wiring and Pneumatic Piping**

- Contractor to furnish and install necessary instrument wiring and pneumatic piping with associated Swagelok fittings, etc.

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**2.4 69 KV Scope of Work****2.4.1 Generator Step-up Transformers (GSUs) Owner Furnished**

- Contractor to install two (2) 13.8KV feeds to Owner's generator step-up transformers.

**2.4.2 Protective Relaying**

- Contractor to supply and install Differential and overcurrent protection relays for transformers.

**2.5 Plant Communication System**

- Contractor to provide communication and public address system for the new plant.
- Contractor to furnish temporary telephones and email capability for construction communication purposes.
- The permanent communication system between the new plant and the TACOA plant will be provided by Owner.

**2.6 Plant Civil and Structural**

Contractor is responsible for the GEO TECH study, soil RESISTIVITY study, and HYDROLOGY to determine the creek levels for proper storm drainage, mud slides.

- Site preparation, rough grading, and finished grading to be furnished by Contractor based on an existing site with the required cut and fill to modify the site to accommodate both the LM6000 and LM2500 gas turbine generators.
- Contractor will furnish retaining walls and shotcrete stabilization of the embankments surrounding the plant site.
- Contractor to furnish and install all plant reinforced concrete foundations designed to IBC 2003. GSU foundation shall have 9" freeboard.
- Contractor to furnish and install concrete containment curbs and equipment foundations.
- Contractor to furnish and install plant gravel and asphalt paving as shown on the Plot Plans.
- Contractor to provide structural steel pipe racks to support overhead piping and cable trays. Pipe racks to be located as shown on Plot Plan drawings.

**2.7 Fencing**

Contractor to furnish and install perimeter fencing with razor wire 3 meters high. Also to include access gate

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**2.8 Plant Buildings**

- Furnish and install a (30ft. x 40ft.) prefabricated metal insulated building for the Control / DCS/PLC room and offices and also auxiliary mechanical equipment. The Control / DCS/PLC room will be air conditioned and finished out as office space.
- Furnish and install a (30ft x 40ft.) prefabricated metal building for the demin water treatment, forwarding pumps, and instrument air compressors.
- Furnish and install (40ft. x 65ft.) prefabricated metal shed over gas compressors

**2.9 Plant Equipment Erection**

- Contractor to unload all Plant equipment delivered to site.
- Contractor will provide all cranes and support equipment and manpower as required to erect the gas turbine generators.
- Contractor to provide for erection of all Owner furnished and Contractor furnished BOP equipment.

**2.10 Cranes, Equipment and Tools**

Contractor to furnish or provide for all plant construction required cranes, fork lifts, back hoes, hydraulic lifts, welding machines, air compressors, generators, temporary lights, trucks, pick-ups, etc. All lifting equipment will be certified. Heavy equipment operators will be certified as trained and qualified for the equipment they are operating.

**2.11 Transportation**

Clover International will furnish transportation from US port to site all Contractor and Owner furnished equipment. Contractor will coordinate the schedule for delivery and offloading of the equipment at site to minimize delays.

**2.12 Lubricants and Chemicals**

- Contractor will supply and install all lubricants, lube oils and chemicals for furnished equipment.

**2.13 Spares**

- Contractor will make provision to supply, receive and store all commissioning spare parts furnished for equipment during start-up and commissioning.
- Contractor to provide Owner with recommended list of spare parts for Gas Turbine Generator and BOP equipment.

**2.14 Construction Offices and Storage Facilities**

- Contractor to provide construction offices for Contractor, Technical Representatives (3), and Owner (7 persons).
- Contractor to provide fenced storage and a lay down area and around the construction site during construction.
- Contractor to provide sanitation facilities for Contractor, & Owner personnel during construction.
- Contractor to provide communication facilities for construction.

## **2.15 Engineering and Project Management**

- Contractor to provide detailed engineering and specifications for all disciplines involved for the power plant including mechanical, electrical, instrumentation, DCS System, civil and concrete foundations.
- Contractor to provide project management complete with construction management, quality control / quality assurance, scheduling, administration, warehousing, and expediting including regular monthly reporting of all disciplines.
- Contractor to arrange for and provide fully qualified technical representatives during erection, testing, start-up, commissioning for the gas turbine generator units and Chillers.
- Contractor to provide startup, commissioning and testing of BOP associated systems.
- Contractor to provide operator and maintenance training for Power Plant on the Gas Turbine Generator Packages, Chillers, DCS, and Balance of Plant.
- Contractor to provide one (1) electronic and two (3) hard copies in English only for used equipment and in English and Spanish for new equipment of the O&M manuals, training manuals, engineering calculations, commissioning and start-up manuals, test manuals, as-built drawings, design specifications and warranty manuals for plant equipment.

## **2.16 Cathodic Protection**

Cathodic Protection will be provided for all steel underground piping.

### Section 3.0 Equipment List - Detailed Division of Responsibility

Material/Responsibility Owner	Qty	Description
<b>Owner</b>	1 Lot	Natural Fuel Gas supply and metered at the PDVSA Station
	1 Lot	Fuel Gas and Liquid Fuel for Commissioning / Start-up that meets the PDVSA Specifications supplied to Contractor by EDC.
	1 Lot	Raw Water Supply from the existing tanks located above the site.
	1 Lot	Raw Water for Commissioning and Startup
	1 Lot	Waste Oil Deposal from the existing Arrecefe Power House
	1 Lot	Permits for Environmental, Importation, Transportation, Operations, etc. to allow plant construction and commercial operations
	1 Lot	Construction & Commissioning Water and 480V three phase power
	1 Lot	Access Roads to site
	1 Lot	Import Duties and Taxes
	1 Lot	Construction lay down area
	1	Fuel Gas Compressor with 50% capacity
	1 lot	Right of Way, easements, etc. to allow proposed interconnects as required
		<b>Gas Turbine Generator</b>
	2	Gas Turbine Generator packages: (1) LM6000 PC & (1) LM6000 PD
	1	Modular Control Building with (2) sets of the following:
		-Turbine Control Panel
		- Generator Control Panel and Protection Panel
		- 24 VDC Batteries and Chargers
		- 125 VDC Batteries and Chargers
		- 125 VDC Rundown motor starter
		- 480V MCC
	1	13.8 KV Generator Breaker NEMA 3R
	1	13.8 KV / 480V 2.3 MVA Transformer
<b>Contractor – ProEnergy EPC Responsibility Civil / Structural</b>		
	1 Lot	Site Preparation, Rough Grading, Excavation, final grading, retaining walls, shotcrete stabilization of the embankments surrounding the plant and fencing
	1 Lot	Construction Tools, Rental Equipment & Rental Cranes
	1 Lot	Temporary Power Distribution
	1 Lot	Plant Concrete Foundations
	1 Lot	Plant Paving, Gravel and Pads for the GTG Turbines and Generators
	1 Lot	Structural piping supports, platforms, ladders, and Misc structural steel supports
		<b>Building</b>
	1	Control Room and Office Building
	1	Demin Water Treatment, Demin Forwarding Pumps, and Firewater Pumps Building
	1	Compressor Building
		<b>Mechanical</b>
	2	Exhaust Stacks with Silencers
	1	Fuel Gas Plant ESD Valve

	2	Dual fuel gas filter skids
<b>Material/Responsibility</b>	<b>Qty</b>	<b>Description</b>
<b>Contractor (continued)</b>		
<b>Mechanical</b>		
	2	50% capacity Fuel Gas Compressors for LM 6000 Plant
	1	Fire Water System with Loop, Monitors and Controls
	1	Demin Water Treatment System
	2	21,000 fiberglass Demin Water Storage Tanks
	2	GTG Duplex Demin Water Filter Skids
	2	Demin Water forwarding Pumps
	1	Duplex Instrument Air Compressor
	1	Oily Water Separator
	1	Waste Oil Tank 5,000 Gallon
	1	Waste Oil Forward Pump
	1 Lot	Pipe, Valves and Fittings with Insulation as required
	1 Lot	Mechanical Labor
	1	Optional 4,000 Ton Inlet Air Chiller with Cooling Tower, Cooling water pumps, and Circulation Pumps.
<b>Electrical</b>		
	1	13.8 KV Generator Breaker Nema 3R
	2	13.8 KV Fused Disconnects (Station Service) NEMA 3R
	2 Sets	13.8 KV Cable Bus from Generator breakers to owner furnished GSUs
	1	13.8 KV / 4160 V 2000KVA Transformer for Fuel Gas Compressors
	1	13.8 KV / 480 V 2000KVA Transformer for Auxiliary Equipment
	1	480 V Distribution Switch board
	1	480 V BOP MCC
	1 Lot	BOP 480/220 V Transformers, Lights, Panels, etc.
	1	120 V UPS System for Control Room
	1	Plant Grounding Grid
	1 Lot	Lightning Protection
	1 Lot	Cathodic Protection for underground steel piping
	1 Lot	Area Lighting
	1 Lot	480 V Welding Receptacles
	1 Lot	Electrical Labor
	1 Lot	Local Subcontractor(s) Civil, Electrical & Mechanical Craft Labor
<b>Instrumentation &amp; Control</b>		
	1 Lot	Plant Instrumentation
	1	PLC based DCS System
	1 Lot	I&C Installation and Construction
<b>Construction</b>		
	1 Lot	Major Equipment Erection
	1 Lot	Mechanical Installation and Construction
	1 Lot	Construction Tools, Rental Equipment & Rental Cranes
	1 Lot	Lubricants, Chemicals, Filters, etc. for Plant Commissioning and Start up
	1 Lot	Balance of Plant Start up and Commissioning Spare Parts

	1 Lot	Transportation of all BOP Equipment to site
<b>Material/Responsibility</b>	<b>Qty</b>	<b>Description</b>
<b>Contractor (continued)</b>		
<b>Construction</b>		
	1 Lot	Plant Commissioning and Performance Testing
	1 Lot	Overall Plant Training
<b>Engineering</b>		
	1 Lot	Conceptual and Detail Design engineering (Total Plant)
	1 Lot	Project Detail Engineering,
	1 Lot	Project Manuals in Spanish including O&M, Warranty, and Engineering Calculations
	1 Lot	As Built Drawings
	1 Lot	Recommended Vendor Spare Parts List
<b>Project Management</b>		
	1 Lot	Project Management with QA/QC, Safety, and Training
	1 Lot	Project manuals in Spanish including project procedures, Systems Turnover Manuals, project implementation, QA/QC, safety and training
	1 lot	Training

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## **Section 4.0 Design Basis and Interconnection Points**

### **4.1 Design Conditions**

#### **Design Conditions (Assumed)**

Site Elevation	100 feet
Air Temperature, High	80° F
Air Temperature, Low	75° F
Maximum Wind Velocity	100 mph
Relative Humidity	78%
Seismic Zone	4
Fuel Gas Supply Pressure	230 psig minimum
Total NOx water Injection	37.5 gpm
Total Sprint water injection	36.2 gpm
High Voltage Interconnect	13.8 KV At Owner GSU
Instrument Air System	185 scfm by Contractor

### **4.2 Interconnect Points**

#### **Interconnect Points with Owner Facilities**

Fuel Gas	Downstream Customer Meter Station 230 psig at the Arrecifes Power House
Plant Waste Water	A waste water interconnect to Owner's existing Waste Water System
Plant Waste Oil	At waste oil tank pump to Owner's truck
13.8 KV	Owner's 13.8 / 69KV GSU's
Telephone	None
Fire Water Supply	At existing Main Firewater Header System adjacent to site
Raw Water Supply	At existing Raw Water Tanks above the site



## **Section 5.0 Expected Performance – Using Natural Gas or Diesel Fuel – With/Without Inlet Chilling (Not Guaranteed)**

The expected performance for the plant is presented in the performance calculations included in this section. Calculations were performed for operation on both Natural Gas for the LM6000 PC sprint and LM6000 PD sprint, with and without Chilling. A performance summary is included below with inlet air chilling to 48°F operating at the Design Conditions listed. Additional calculations were performed at higher ambient temperature for 48°F inlet air. A performance summary is attached on the following pages.

### **TACOA LM6000 PC Sprint & PD Sprint**

<b>80°F; 70% RH; 100 ft</b>			
	<b>Natural Gas 951.6 BTU/lb LHV</b>		
	<b>LM 6000 PC spt</b>	<b>LM 6000 PD spt</b>	<b>Total (Both) Units</b>
<b>Gross GT Power ea. (kW)</b>	<b>45687</b>	<b>42401</b>	<b>88088</b>
<b>Net LHV HR (BTU/kWh)</b>	<b>8873</b>	<b>8601</b>	<b>8744</b>
<b>Net Power (kW)</b>	<b>44551</b>	<b>41367</b>	<b>85918</b>
<b>Auxiliaries (kW)</b>	<b>1136</b>	<b>1034</b>	<b>2170</b>
<b>Fuel usage (pph)</b>	<b>19910</b>	<b>17920</b>	<b>37830</b>
<b>Fuel usage (MMSCFD)</b>	<b>9.65</b>	<b>8.69</b>	<b>18.34</b>
<b>Fuel Chemical LHV per GT (kBTU/h)</b>	<b>395319</b>	<b>355802</b>	<b>751121</b>
<b>Fuel Chemical HHV/LHV ratio</b>	<b>1.105</b>	<b>1.105</b>	<b>1.105</b>
<b>Water Injection (pph)</b>	<b>18380</b>	<b>N/A</b>	<b>18380</b>
<b>Water Injection (gpm)</b>	<b>36.76</b>	<b>N/A</b>	<b>36.76</b>
<b>Sprint (pph)</b>	<b>9046</b>	<b>8992</b>	<b>18038</b>
<b>Sprint (gpm)</b>	<b>18.09</b>	<b>17.98</b>	<b>36.07</b>

<b>Inlet chilled to 48°F w/ &lt; 4000 tons total chilling (about 2900 tons for these conditions)</b>			
<b>80°F; 70% RH; 100 ft</b>			
	<b>Natural Gas 951.6 BTU/lb LHV</b>		
	<b>LM 6000 PC spt</b>	<b>LM 6000 PD spt</b>	<b>Total (Both) Units</b>
<b>Gross GT Power ea. (kW)</b>	<b>51143</b>	<b>46977</b>	<b>98120</b>
<b>Net LHV HR (BTU/kWh)</b>	<b>8871</b>	<b>8503</b>	<b>8695</b>
<b>Net Power (kW)</b>	<b>49315</b>	<b>45286</b>	<b>94601</b>
<b>Auxiliaries (kW)</b>	<b>1829</b>	<b>1691</b>	<b>3520</b>
<b>Fuel usage (pph)</b>	<b>22040</b>	<b>19396</b>	<b>41436</b>
<b>Fuel usage (gpm)</b>	<b>10.69</b>	<b>9.41</b>	<b>20.1</b>
<b>Fuel Chemical LHV per GT (kBTU/h)</b>	<b>437476</b>	<b>385076</b>	<b>822552</b>
<b>Fuel Chemical HHV/LHV ratio</b>	<b>1.105</b>	<b>1.105</b>	<b>1.105</b>
<b>Water Injection (pph)</b>	<b>23220</b>	<b>N/A</b>	<b>23220</b>
<b>Water Injection (gpm)</b>	<b>46.44</b>	<b>N/A</b>	<b>46.44</b>
<b>Sprint (pph)</b>	<b>8600</b>	<b>6880</b>	<b>15480</b>
<b>Sprint (gpm)</b>	<b>17.2</b>	<b>13.8</b>	<b>31</b>

## **6.0 Plant and Equipment Warranties**

Balance of Plant Warranties – Contractor will obtain from all equipment vendors their warranty on the material and equipment provided. These warranties will be for a term of 12 months from commercial operation (full power) date and if a replacement is required, for a term of 12 months following such replacement. The warranty for each component will include replacement of the item as well as the Contract labor cost to replace and install.

This vendor warranty information will be assembled and packaged into a Warranty Manual. The Warranty Manual will provide vendor name and contact information, component description, and model number. The warranty Manual will be provided to the Owner.

---

## **Section 7.0 Project Management and Organization**

### **7.1 Project Management Execution**

#### **7.1.1 Project Management Team (Typical)**

The Contractor will assemble a well qualified and experienced team of individuals who have worked together on many previous projects.

The team will be comprised of:

- Project Manager
- Administration Manager
- Project Technical Consultants
- Construction Manager
- Purchasing / Expediter
- Scheduling
- QA/QC
- Project Engineering Manager
- Site Erection
- Commissioning / Start up Managers
  - Mechanical
  - Electrical
- Mechanical Construction Superintendent
- Electrical Construction Superintendent
- Training

The team as outlined above has worked together on many gas turbine generator power plants within the US as well as internationally. They have successfully completed a number of "Fast Track" projects internationally.

#### **7.1.2 Project Manuals**

One of the first tasks to be initiated is the preparation of the project specific project manuals. These manuals are listed:

- Project Procedures
- Project Implementation
- Project Engineering Calculations
- Project Warranties
- QA/QC
- Safety
- Training
- Operation and Maintenance
- Commissioning, Start Up, and Turnover
- Project Performance Test

### **7.1.3 Project Schedule**

Along with the commencement of preparation of the project manuals, the detailed project schedule will be started. This detailed schedule will be developed utilizing Microsoft Project. The project schedule will be a living document which will be continually updated by a full time assigned scheduler for the life of the project. The proposed project schedule is included in Section 8.0.

### **7.1.4 Project Engineering**

Preliminary conceptual engineering has been developed during the proposal phase which consists of:

- General Arrangement Plot Plan
- Process Flow Diagram
- One Line Diagrams

The conceptual drawings listed above are immediately completed after project Notice to Proceed. This entails updating the various drawings based on final agreed upon items with the Owner and/or Owner's Engineer. The Process Flow Diagram is completed with the latest heat and material balance. The One Line Diagrams are further developed to reflect loads, breaker / fuse sizing, DL power, etc. The Control System Drawing is likewise further completed reflecting agreed upon HMI's, printers, Balance of Plant Equipment PLC's, etc.

The conceptual engineering is completed utilizing the project technical consultants (responsible for proposal preparation) and the detailed engineering team to guarantee a smooth hand over to the detailed engineering phase.

During the conceptual engineering phase, specifications are finalized for all engineered equipment to be purchased. On a "Fast Track" project most of the engineered equipment has been preliminarily specified with only final checks and agreed upon modifications made.

Detailed engineering will be completed utilizing the conceptual drawings previously described and with Owner approval. This detailed engineering will include: engineering protocol for drawings and specification.

As-built drawings will be completed upon completion of the installation phase of the project.

### **7.1.5 Owner Approval**

It is proposed that three approval steps be in place for the engineering phase of the project. These steps would be 30%, 60%, and 90%. The Owner or Owner's Representative could travel to the Contractor or vice versa at the Owner's request.

---

### **7.1.6 Project Procurement**

Major engineered equipment which has been specified during the proposal and configuration phases of the project are submitted on the agreed upon approval process and when approved will be purchased.

The Balance of Plant Equipment and materials (normally short delivery) will be itemized and listed during detailed engineering. A decision will be made as to who will furnish (Contractor or Subcontractor) based on job conditions, locations, etc.

### **7.1.7 Construction Phase On Site**

The project management team will move to the site for the construction phase of the project. This phase is further described as follows:

#### **1. Mobilization**

A mobilization and construction lay down plan will have been prepared as part of the Project Implementation Manual. This would include setting up the normal required items.

- Construction offices
- Site utilities
- Secure and non-secure lay down areas
- Communications
- Project management housing, transportation, food, etc.
- Arrangements for major equipment rental
- Surveys, soil tests, etc.

#### **2. Project Construction**

Project construction will be carried out utilizing local subcontractors and materials where feasible. Contractor will furnish construction management and detailed supervision of all disciplines.

#### **3. Commissioning and Turnover**

Commissioning and Turnover Manuals will be prepared for each discrete system making up the power plant. An experienced and knowledgeable commissioning and turnover team will be assigned under the supervision of a well qualified start-up manager. This team will commission on a "priority system" basis the various systems to provide for plant start up. It is desired that plant operation and maintenance personnel be involved to provide valuable hands on experience.

#### 4. Training

Operation and maintenance training will be conducted in two phases:

- General Electric LM 6000 GTG equipment classroom at the site subject to plant operator preference.
- On site balance of plant operation and maintenance.

Formal training manuals will be prepared with formal on site training to be conducted.

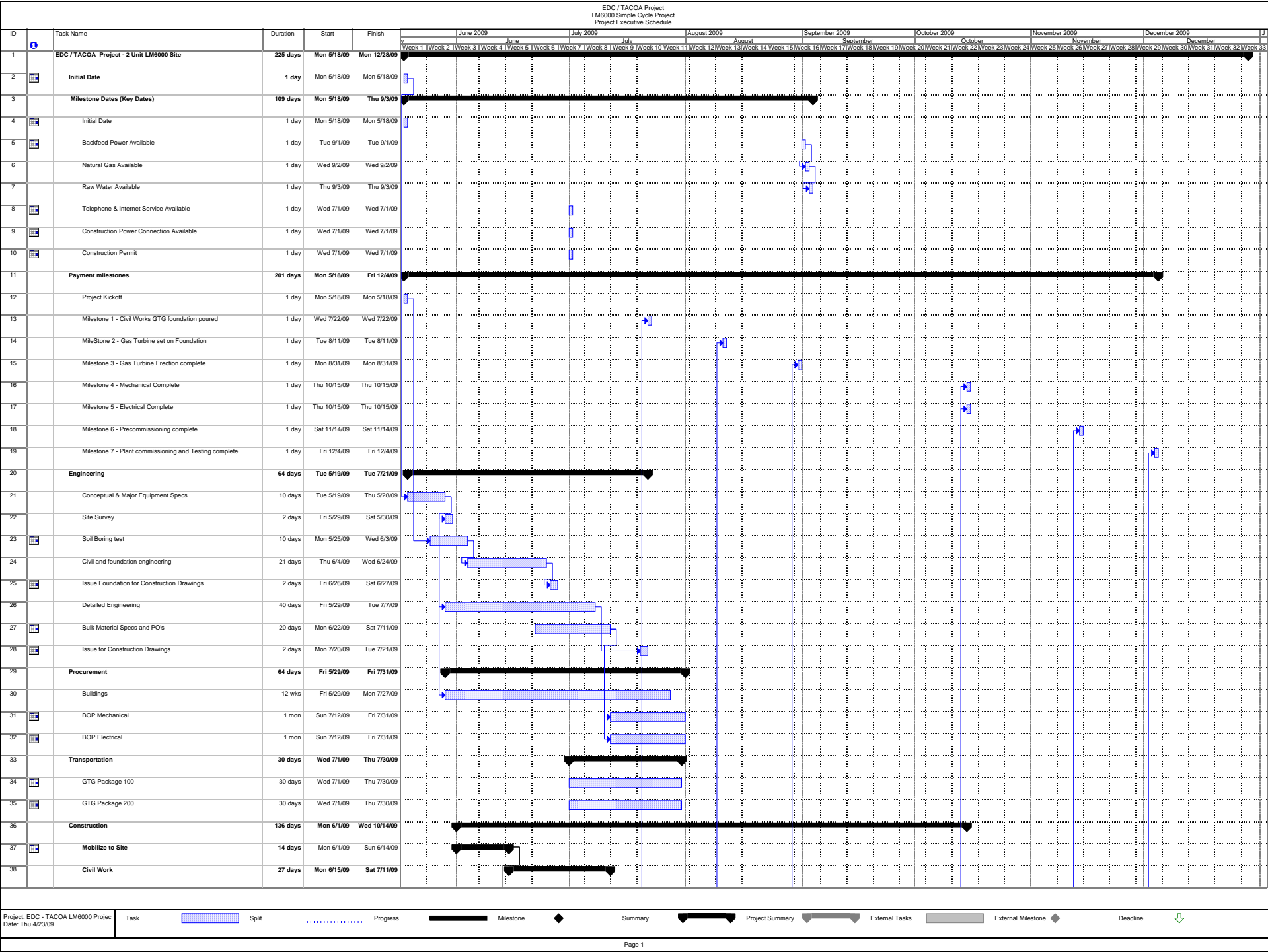
#### 5. Plant and Performance Testing

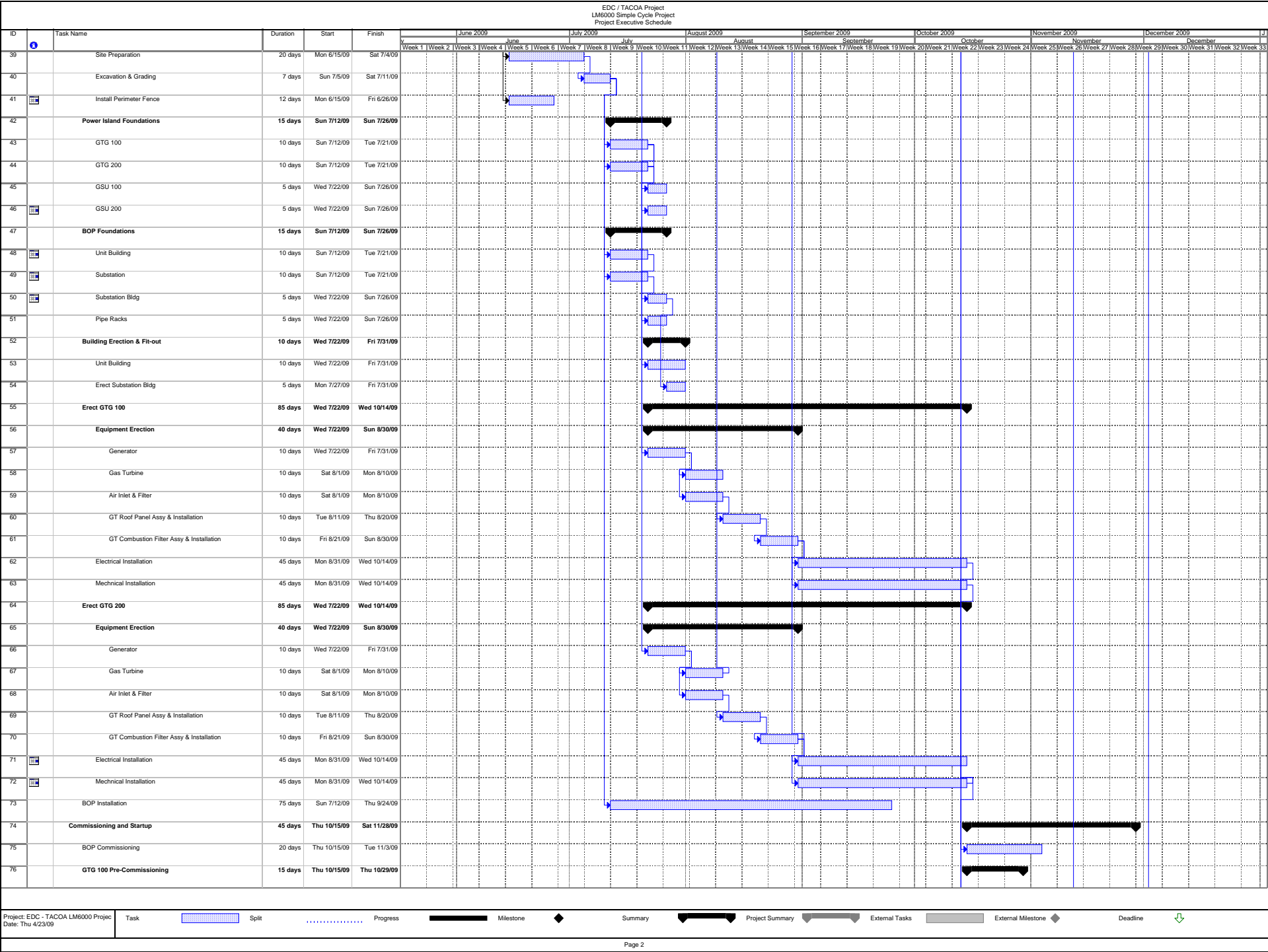
Plant and performance test documents will be prepared and submitted for approval. The formal tests will be conducted on an agreed time with the necessary Owner's Representatives attending.

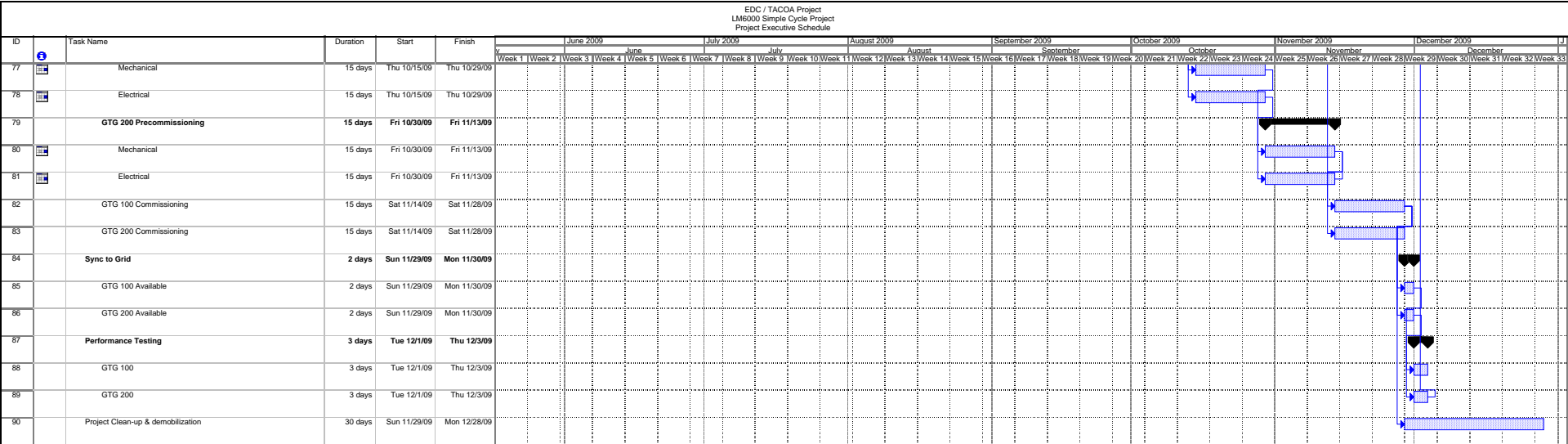
## **8.0 PROJECT SCHEDULE**

Below is ProEnergy EPC Services' proposed schedule for the LM6000 Tacoa Power Plant Project.









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## **PART 1 PROJECT QA/QC PLAN**

### **I. INTRODUCTION**

Our employees have over 40 years of history with EPC projects for the Power Generation industry. As a turnkey engineering and construction contractor, we have followed stringent quality guidelines throughout its history. The QA/QC Controls in place have been developed and fine tuned over these multiple and varied project experiences. The QA/QC plan that exists today is based upon experience in interpretation and application of codes and standards as well as practical knowledge learned in expeditiously bringing a project to successful completion.

The following sections will provide a detailed description of the Corporate Policy regarding Quality Assurance/Quality Control and a Project Specific Plan for the Quality Assurance/Quality Control management of the Power Project.

### **II. ORGANIZATION**

The Quality Assurance Manager acts as the point-of-contact for any non-conformance reports and initiates corrective action as required. He/she ensures that required inspections, tests, evaluations, reviews, audits and all other quality control measures are performed as necessary to strictly adhere to the corporate-approved Quality Control and Assurance program plan. The Quality Assurance Manager is assisted by a team of inspectors who conduct all manners of inspections and tests required, ensuring that the installed system conforms to the approved drawings and specifications.

An organization chart is furnished which shows the organization of the Quality Control and Assurance Team by position, title and name. All quality control team personnel will be assigned based upon individual and collective expertise as related to the specific areas of quality control necessary to support the contract work effort.

### **III. PLAN TASKS AND PROCEDURES**

#### **A. Construction Design**

##### **1. Design Documentation Review - Drawings**

Project Engineers are responsible for conceptualizing and engineering the project. To ensure that the design meets all requirements, inspections will be conducted throughout the design process. Prior to issuance of "Issue For Construction" package, all drawings will have the following signatures and dates.

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Draftsman	Signature and Date in Drawn By Block
Checker	Signature and Date in Check Block
Project Engineer	Signature and Date in Design Block
Project Manager	Signature and Date in Project Manager Block
QA Manager	Signature and Date in QA Block

The Project Engineer responsible for the drawing design will initial his approval on all completed drawings. Fundamental configuration drawings (i.e., PFD, P&ID, Electrical One-lines, and Control Configuration drawings) will undergo peer review. Selection of the peer reviewer will be made jointly by the Senior Engineering Manager and the QA/QC Manager. The Quality Assurance Manager will check the drawing for all necessary signatures and initials and will then sign his name and date. The Drawing Review Sheet will be filed by the Quality Assurance Manager as a permanent project record.

Changes to approved drawings require the same review process. Changed drawings will be issued as revisions and will be labeled as such.

## **2. Design Documentation Review - Specifications**

A specification will be generated for each major piece of equipment to be purchased for this project. The Project Engineer responsible for the generation of each specification will initial the completed specification. Prior to each specification's attachment to a Request for Bid or a Purchase Requisition, this specification will undergo peer review by the Project Manager and the Engineering Manager. The Specification will then be passed to the QA/QC Manager for his review and will become a permanent part of the project record.

## **3. Drawing Control**

A Master Drawing Index of all drawings will be maintained. The index will be updated as drawing changes occur and will reflect the current status of each drawing. Only the latest applicable drawings, specifications, instructions and authorized changes thereto, will be issued for manufacturing, construction, inspection and testing. Reproducible copies or computer disk files of final revision levels of a drawing will be maintained for record.

## **B. Subcontracted Design**

The same approval and quality assurance procedures to which own design work is subjected will also be applied to all design work subcontracted to an outside source. Drawings and other design documents will be reviewed and examined for compliance with both the technical and format requirements of the contract specifications.

## **C. Material Procurement**

Responsibility for procurement of various equipment and supplies will be clearly defined prior to the initiation of any procurement. Purchasing Manager and staff will directly monitor all procurement efforts of major equipment under their immediate control.

Balance of Plant purchasing, i.e., Buildings, Mechanical, Electrical (conduit, fittings and wire), and Area Lighting will be the primary responsibility of the various subcontractors. Some of the project tasks will be purchased as a sub-system or system from different vendors or subcontractors. In order to ensure adherence to the project schedule, will direct scheduling and expediting of materials and equipment purchased by subcontractors.

### **1. Procurement Procedures**

Procurement Procedures are published in the Corporate Project Procedures Manual. The following sections detail Procurement Procedures for this project. We implements these controls for every large project to ensure that the client receives the best value in materials and equipment as well as a quality installation effort.

#### **1.1 Prequalification of Manufacturers / Vendors / Construction Contractors**

Select Manufacturers / Vendors / Construction Contractors based on our own Qualified Vendors List (QVL). The stated purpose of the QVL is to ensure the best value and the highest quality in workmanship, materials and equipment for and our clients. Each manufacturer / vendor / contractor listed on the QVL has been evaluated based on past performance using the following criteria:

- Proper documentation of and compliance with inspection/test requirements
- Quality of workmanship
- Efficient handling of Purchase Orders
- Adherence to shipping schedules
- Prompt resolution of non-conforming material problems
- Compliance in manufacture and supply with specifications
- Warranty Work
- Product or Product Lines
- QA/QC audit (if necessary)
- Price

New vendors / contractors with no previous history are evaluated based upon the following:

- Product Lines
- Project Histories for similar projects

- Discussion with former Client Contacts
- Financial Stability
- Staff Qualifications
- Capability to complete the project
- Financial Stability
- QA/QC Audit (Manufacturers / fabricators if necessary)
- Client List

## **1.2 Material / Equipment / Parts / Services Selection**

This section provides an overview of methodology in selecting materials, equipment, parts and services. Expediting procedures are included to ensure that the project schedule is not impacted by shipping delays.

The established twelve main stages in the procurement of materials, equipment, parts and services:

- Preparation of the Specifications for equipment and materials
- Identification of each item and preparation of purchase requisitions
- Issuing the Request for Quotation
- Quotation Review, Negotiations and selection of vendor or contractor
- Preparation and Placement of the Purchase Order
- Scheduling delivery of the Purchase Order
- Expediting the Purchase Order
- Receipt of Materials/Equipment/Parts and Inspection of same
- Inspection of Contracted Services and Approval of Same
- Resolution of any Non Conforming Material problems as well as any Corrective Action Items
- Field Purchase Orders

## **2. Equipment / Material Specification Preparation**

Procurement specifications originate in the Engineering Department. The Engineering Manager will task staff engineers with the generation of specifications. The Engineering Manager and the Project Manager will review the equipment specification for compliance with applicable codes/standards and contract specifications. If Client approval is required, the Project Manager will forward specification to Client, obtain approval signatures, and then return the approved specifications to the Engineering Manager.

Standard Specifications are divided into two (2) classes, "short form" and "book type." Short form specifications are used whenever good engineering practice and contractual arrangements permit. They are simple and flexible. "Book type" specifications are more formal, more expensive, and may be used on major engineered items of equipment, usually at the request of the Client.



## **2.1 Purchase Requisitions**

Purchase Requisitions will originate with engineering. The Purchase Requisition will be approved by the Project Manager or Engineering Manager prior to submittal to the Purchasing Department. The Requisition will be checked by either the Engineering Manager or the QA/QC Manager for compliance to specifications. The Purchase Requisition will then be forwarded to the Purchasing Manager. The Purchasing Manager will direct that the Request for Quotation (RFQ) be developed and sent to approved suppliers on QVL. The specifications developed by Engineering will be attached to the RFQ.

The vendor or subcontractor shall be given sufficient time to prepare their bid for equipment or services. The time frame for bidder response shall be so stated on the RFQ.

## **2.2 Quotation Reviews**

Each quotation will be reviewed prior to the issue of a Purchase Order. Major Equipment, Material, and Contracted Services purchases will be reviewed by a representative from the applicable engineering discipline and project management.

## **2.3 Purchase Order**

Following evaluation of quotations and completion of negotiations, an award will be made. The Purchasing Manager will generate the Purchase Order.

Purchase Orders include the following:

- Detailed description of products and services
- Required delivery date
- Test and Inspection requirements, if applicable
- Terms of payment
- Shipping information and point of contact
- Required documentation

A Purchase Order Log will be maintained at all times. Purchase Progress Reports will be updated weekly.

### **2.3.1 Expediting the Purchase Order**

Purchasing Manager will delegate an expeditor to track delivery of major equipment and materials for the project. The expeditor will closely monitor the progress in fabricating or gathering of materials from each vendor of equipment and materials which could impact the project schedule.

### **2.3.2 Closing out of Purchase Orders**

Documented receipt of equipment / materials in good order will be forwarded to the Administrative Manager and the Purchasing Manager. Contracted services will be inspected and signed off upon satisfactory completion. At this time, the Administrative Manager will sign these documents and direct the Purchasing Manager to forward same to Accounting for payment. Payment will be by terms agreed to on Purchase Order.

### **2.3.3 Field Purchase Orders**

Field Purchase Orders will require approval from Purchasing Manager. Field Purchase Orders will be documented, and a written Field Purchase Order Log will be maintained.

## **2.4 Material / Equipment Receiving Inspection**

Receiving Inspections will be performed on all major equipment / material for the project. QA/QC project staff will perform the inspection. Methodology is discussed in detail in the project QA/QC Section of this document.

All materials requiring Material Certifications and/or Material Test Reports (MTRs) will be checked for compliance to project specifications. Materials received without the proper certifications will be tagged and segregated until such required documentation is received.

### **2.4.1 Hazardous Materials Storage**

All coating materials, lubricants, flammable solvents, and other items identified by the Project Manager or the Owner as falling under Hazardous Material designation will be segregated from other project materials and equipment. These items will be stored in a secure location. All MSDS sheets will be posted in this area concerning each type Hazardous Material. An inventory will be maintained detailing receipt and issuance of any said material to installation staff and/or subcontractor.

If a subcontractor will directly receive or bring upon jobsite any materials in this category, they will be directed to comply with the established HAZMAT storage materials plan. This plan will be issued as a separate document and will be available at site for all personnel to review.

## **2.5 Corrective Action / Non-Conforming Equipment / Materials**

All equipment / materials which do not reflect compliance to project specifications, shipped without MTRs, damaged in shipment, etc. will be tagged and segregated until such time as vendors resolve the problem. Methodology for these processes is discussed in detail in the QA/QC section of this document.

## **D. Test Plans**

Test plans will be developed for testing each segment of the project both independently and collectively. Test plans will explain the purpose of the tests, define inputs, specify procedures, and acceptance criteria.

### **1. Measurement and Test Equipment**

Measurement and test equipment used for inspection and acceptance testing shall be calibrated at established intervals against certified standards. All subcontractor and vendor test equipment used for vendor acceptance testing in connection with this contract shall meet the same calibration requirements.

### **2. Documentation**

Inspection and testing documentation will be prepared in clear language. Test procedures will define all conditions and materials required for the test, specify test equipment and provide pass/fail criteria.

Reports will be prepared to document the results of each inspection and test performed. The records will identify the test equipment used, the observations made, the deficiencies found and the corrective actions taken.

### **3. Definition of Test Types**

- a. Factory Tests are defined as tests performed at the location where the item is produced, fabricated, manufactured or assembled prior to shipment to the site.
- b. Field Verification Tests or Pre-Operational Tests are tests performed after installation. These tests verify that components and subsystems are installed and perform correctly.
- c. The Operational Systems Test is a comprehensive test of the installed system. The results of this test determine acceptance or rejection of the system.
- d. Performance tests are a series of tests to verify project-mandated performance guarantees.

## **E. Corrective Action**

When problems or deficiencies are discovered in workmanship and/or materials during the inspection process, they will be documented. The inspector will prepare a Corrective Action Request (CAR) detailing the problem and submit it for resolution. The QA Inspector will forward the CAR to the QA Manager and the Project Manager. Corporate

Project Management will investigate the problem and direct the proper course of action. All Corrective Action Requests shall be maintained for future reference or analysis as may be required.

#### **IV. INSPECTION REQUIREMENTS**

##### **A. Responsibilities**

Perform the inspections and/or tests required to substantiate that the materials and services conform to requirements. The Client may witness any of the inspections or tests. All errors and/or defects discovered during inspections and/or tests shall be documented.

##### **B. Classification of Test**

Test Classifications include factory testing of components and major subsystems, field testing, and on-site final acceptance testing of the complete system. Some of the individual component and subsystem testing may be performed concurrently with the Operational Test. Construction Inspections will be performed during the installation work.

##### **1. Factory Testing**

Factory testing will be accomplished as required to ensure compliance with the contract specifications. Prior to shipment from the factory, some components and/or subsystems may be tested to demonstrate their compliance with the specifications. These items shall be identified and noted on the purchase order.

##### **2. Operational System Test (OST)**

A test of the entire System in full operational mode will be conducted to verify correct operation of all subsystems and system components. All functional capabilities of the system will be demonstrated. Following completion of the test, we will prepare and submit a test report.

These test procedures will be developed during the project construction phase and will be delivered to the client for approval prior to Operational Testing efforts being undertaken.

##### **4. Performance Tests**

A series of tests will be conducted to verify project performance guarantees. These tests will include

- Gross power output in kW
- Parasitic Load
- Net Power Output in kW
- Gross and Net Heat Rate

### **C. Test Documentation**

The Quality Assurance Manager will ensure that test procedures and test reports are prepared as outlined herein. Test documentation will be issued to the client. Test procedures will be developed for testing components, subsystems and the overall system. Testing shall demonstrate that the system design meets the requirements and that materials and workmanship are as specified. Test results shall be recorded and bound with the test procedures to form a permanent record.

## **V. PROJECT SPECIFIC INSPECTIONS AND TESTS**

The project warrants a wide variety of inspections and tests. The following sections briefly describe the project inspection and test requirements by function and/or discipline.

### **A. Site Preparation**

- Confirmation of site dimensions.
- Confirmation of topographical elevations on completion of final grading. assumes existing elevation is within two (2) feet of final grading level.
- Confirmation of Water Run Off Control after Final Grading is achieved
- Review of complete soil compaction and associated tests.

### **B. Ground Grid**

- Confirm grid installed at correct depth and dimension with correct materials.
- Observe and confirm that junctions, splices, and taps are made with the correct Thermic weld type molds or pressure connectors and tools.
- Observe and confirm that correct wire and size are used with regard to ground rods.
- Perform ground grid resistance test.

### **C. Concrete Foundations, Walls and Slabs**

- Confirmation of correct locations and dimensions of concrete foundation and wall forms.
- Confirmation of correct size and spacing of rebar in concrete foundations.
- Confirmation of proper anchor bolt sizes and location.
- Verify procurement of correct concrete strength.
- Witness the taking of necessary concrete samples for "slump" and "strength tests."
- Obtain qualified testing lab for concrete strength tests.
- Confirm proper correct elevations and slope of all slabs, walls, etc.
- Document above items on concrete pour card.

**D. Electrical**

- Witness factory tests for correct power and control on all motor control centers (if applicable).
- Confirm the receipt of each major item of electrical equipment. Verify specification compliance and inspect for transit damage.
- Confirm that receipt of all equipment and miscellaneous materials - conduits, cabling, etc., adhere to procurement requirements.
- After wiring is pulled and prior to connection, the wire will be Megger tested and all test results will be recorded on a Megger / Hi-Pot Test Record Form.
- Observe all conduits routing to ensure adequate turning radius for cable pulling.
- Perform detailed point-to-point wiring checks to verify power, control, and instrument wiring.
- Perform pre-operational tests on all electrical equipment and systems.
- Confirm tagging and labeling, verify and document as-built drawings.

**E. Structural Steel**

- Confirm correct size and type of structural steel.
- Confirm proper installation of anchor bolts, washers, and nuts installed, as required.
- Verify that qualified welders perform welding in accordance with applicable codes.
- Visually inspect all field welds to confirm they are complete and adequate.
- Verify paint and corrosion protection.

**F. Piping and Welding**

- Confirm correct size, rating, etc., of each piping system as applicable.
- Verify that qualified welders are utilized. Inspect piping fit up to ensure proper workmanship is utilized.
- Obtain qualified testing lab for welding radiography.
- Set up welding inspection and test procedures in accordance with applicable codes and standards.
- Set up a detailed welding documentation system to address individual pipe code, each weld, x-ray, welder, welding map, date, and inspector review.
- Establish a pipe cleaning procedure.
- Witness hydrostatic testing and test procedures, as required by various codes for each piping system.

**G. Instrumentation**

- Confirm all instrumentation and control equipment adheres to procurement requirements.
- Confirm instrumentation specification compliance, and inspect for transit damage.
- Observe individual calibration of each instrument, confirming range, accuracy, etc. in accordance with specifications and applicable codes.
- Perform functional loop checks and document same.

**H. Documentation**

Test and Inspection Documentation will be maintained on site throughout the project construction, commissioning and startup phase. The client will be allowed access to this data at any time.

Following Completion of Startup and Commissioning, the full battery of project Testing and Inspection Documentation will be delivered to the Client.

**VI. SHIPPING AND HANDLING**

Procedures for shipping and handling of materials will ensure that all shipments meet the requirements for identification, packing, packaging and data submittal. Contractor will be responsible for packing, shipping, receiving and installing the component parts and subsystems that comprise the complete system. The degree of protection and method of handling will be consistent with the anticipated hazards.

Contractor will ensure that the appropriate shipping and handling procedures will be followed. Should damage occur in transit, it will be repaired or replaced as appropriate.

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## **PART 2 PROJECT SPECIFIC TEST AND INSPECTION PROCEDURES**

### **I. SCOPE**

The following civil, mechanical and electrical test and inspection requirements have been developed for the project.

The civil, mechanical and electrical tasks on this project shall comply with the standards set forth in this document to ensure both the safety and quality of the installation. This document stipulates the inspections and tests that will be performed on the project.

### **II. STANDARDS AND CODES**

The following organization's standards and codes are applicable to design and construction practices for the project.

ANSI B31.3	Plant Piping
ASME IX	Welder Qualifications
AWS A3/0	Definitions of Welding Terminology
AWS B2.1-84	Standard for Welding Procedure and Performance Qualification
AWS D1.1	AWS Code for Structural Welding
AISC	American Institute of Steel Construction – Various sections
ASTM	American Society for Testing Materials – Various Sections
ASME	American Society for Mechanical Engineers – Various Sections
ISA S5.1	Instrumentation Symbols and Identification
NACE RP018890	Standard Recommended Practice: Discontinuity (Holiday) Testing of Protective Coatings
NEMA AB1	Molded Case Circuit Breakers
NEMA ICS1	General Standards for Industrial Control and Systems
NEMA ICS2	Industrial Control Devices, Control and Systems
NEMA ICS4	Terminal Blocks for Industrial Use
NEMA ICS6	Enclosures for Industrial Controls and Systems
MG1	Motors and Generators
PE5	Constant-Potential-Type Electric Utility (Semi-Conductor Static Converter) Battery Chargers
SG2	High Voltage Fuses
WC2	Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy
NFPA70	National Electric Code
NFPA No. 1	Carbon Dioxide Extinguishing Systems
NFPA No. 37	Stationary Combustion Engines and Gas Turbines
OSHA CFR Title 29	Occupational Safety and Health Administration
(Note: Codes and Standards may also include Codes and Standards issued by other organizations as directed by Owner.)	

### **III. TESTS / INSPECTIONS - CIVIL**

Inspections will be undertaken throughout the civil portion of the project. The site dimensions will be confirmed. Topographical elevations will be confirmed following grading. All concrete slab and wall dimensions will be confirmed prior to concrete pouring. All concrete will be confirmed to be compliant with design specifications. A qualified third party inspection agency will be retained to conduct slump tests prior to and during concrete pours. All concrete will be strength-tested intervals per ASTM standards. Grouting of mechanical equipment skids will be performed per the developed specifications.

### **IV. TESTS / INSPECTIONS - GROUND GRID**

The ground grid will be inspected throughout installation to ensure that materials used are per design specifications and that installation splices, junctions, and taps are made properly. Depth and dimensional boundaries will be measured and recorded. At the conclusion of installation, the grounding grid will be tested using a test instrument specifically for the task to confirm acceptable impedance levels.

### **V. TESTS / INSPECTIONS - MECHANICAL**

Several elements of the project will require welding during fabrication and installation. These elements include:

- Structural Steel
- Fuel System - Natural Gas Fuel System Piping
- Fuel System - Liquid Fuel System Storage Tank and Piping
- Process Water Systems
  - Raw Water System Storage Tank and Piping
  - Waste Water System Piping
  - Firewater System Piping (HDPE piping Thermal Welding Inspections)
- Oily Waste System
- Lube Oil System

The welding inspection criteria for each of these tasks will be based upon the applicable codes and standards. The following paragraphs briefly describe each task and stipulate the specific code and/or standard(s) that apply.

#### **A. Structural Steel**

The structural steel aspects of the project will consist of the building related structural steel and various supports of racks. Design and erection of these assemblies shall be in accordance with the latest edition of the AISC. All welding will be visually inspected per AWS applicable codes and standards.

---

**B. Welding Inspections/Tests**

All welders are required to have current certification of their qualifications. Current certifications should indicate the welder has been tested to the project welding procedures within one year prior to welding on project piping.

All visual-welding inspections will be performed by persons who have current certification from AWS or ASNT-TC-1A. All NDE will be performed and approved by persons holding current ASNT-TC-1A Level II certification for the specific test processes implemented. All visual welding inspections will be performed based on the criteria established in ANSI B31.1 and AWS D1.1.

Radiographic Testing (RT) where necessary will be performed in accordance with standards established by ASME Boiler and Pressure Vessel Code, Article 2, Section V, except as stipulated in the applicable code, ANSI B31.3 (Pipe welding inside Plant Battery Limits).

Welded Steel Storage Tank welding and erection inspections/tests will be performed per API 650 (Welded Steel Tanks for Petroleum Storage).

All radiographs of full penetration welds must be accepted by a certified Level II inspector with current certification under ASNT-TC-1A. Accept/Reject criteria for all welds shall be in accordance with criteria established as well as applicable codes. Any rejections will require two (2) weld penalty shots on that welder. If in the judgment of the Site QA/QC Manager that a welder or welders have excessive rejections; may demand the welder be removed from the project or certified to weld on only non critical piping.

If the Client wishes, all radiograph films will become the property of Client and will be submitted with the accompanying reader sheets within two (2) weeks after completion of the project. The client may review the films and accompanying interpretations at any time at the project site. If the client does not desire the films, they will be destroyed at the completion of the project.

**C. Natural Gas Piping**

The Natural Gas Fuel System piping shall consist of piping installed from Client's source of supply to the Fuel Gas Compressors and on to Fuel Filter/Separators and finally to the Gas Turbine Generators. Piping from the supply source to the Fuel Gas Compressors and subsequently to the Fuel Filter/Separators will be Carbon Steel. The piping on the downstream side of the filter/separators to the will change to Stainless Steel piping. All Natural Gas piping will be designed and constructed to ANSI B31.3.

A total of 100% of the pipeline welds (100% of each weld) will be subjected to Radiographic Testing (RT).

All radiographs of full penetration welds must be approved and accepted per criteria established in Section B above.

**D. Liquid Fuel System**

The liquid fuel system consists of a double walled piping system from the storage tank underground to the filter skid. From the fuel filter skid, the piping changes to stainless steel between the skids and the gas turbine.

The double wall piping system will consist of 8" carbon steel piping with a Schedule 40 Polyethylene (PE) or Reinforced Thermal Resin (RTR) flexible 4" liner within. All carbon steel piping will be performed under ANSI B31.3. The bonding of the PE shall be performed under ASTM D-2104. If the piping system will be RTR ASTM 2996.

All piping systems will be visually inspected by Craft Inspectors qualified to visually inspect these systems. 10% carbon steel piping welds will undergo RT, 100% of the weld. RTs will be examined and approved by a Level II or III ANSTC-1A qualified technician.

PE or RTR lines will undergo hydro or pneumatic testing. If Hydrotest is used, water as the test medium hydro will be 1.5 times design pressure up to a maximum of 150 PSI. If a pneumatic test is decided upon, the test pressure will be 1.2 times design pressure.

**E. Lube Oil System**

The Lube Oil system consists of a skid and interconnecting stainless steel piping to the Gas Turbine Package. All interconnecting pipe welds shall be in accordance with ANSI B31.1. All Lube Oil system welds will undergo visual inspection or testing in accordance with ANSI B31.1. Ten percent (10%) of these welds will undergo RT testing (100% of the weld)

**F. Hydraulic System**

The Hydraulic System consists of a skid and interconnecting stainless steel piping to the Gas Turbine Package. All interconnecting pipe welds shall be in accordance with ANSI B31.1. All Hydraulic system welds will undergo visual inspection or testing in accordance with ANSI B31.1. Ten percent (10%) of these welds will undergo RT testing (100% of the weld)

All radiographs of full penetration welds must be approved and accepted per criteria established in Section B above.

**G. Raw Water System**

The Raw Water System consists of Carbon Steel Piping from the city water supply Water Day Tank. The Raw Water System Raw Water Pump then supply the Water Treatment and Demineralized Water Treatment systems via Carbon Steel Piping Systems.

Raw Water System piping welds will be visually inspected.

## **H. Process Water Systems**

The process water systems consist of:

- The Lube Oil Cooling Water system shall consist of pumps and Carbon Steel Piping to and from Fin Fan Coolers to the Gas Turbine Lube Oil Skids
- The Oily Waste System consists of PVC Piping from Oil Containment areas located at various sites within the BOP to the new Oily/Water Separator

All welded steel piping will be visually inspected as welds are completed. All PVC piping joints will be inspected as they are made up. The Process water systems will be inspected prior to startup. All pumps will be balanced. Remaining components will be inspected and confirmed that they are supplied and installed per specifications.

## **I. Fire Water System**

The Fire Water System consists of HDPE Piping from the City Water Supply to the Fire Water distribution system.

## **J. Pump Testing**

All pumps supplied will be balanced and confirmed as fully operational prior to startup.

## **VI. WELDER QUALIFICATIONS**

Welders qualified according to the appropriate codes shall make all welds on the project:

- |                                   |               |
|-----------------------------------|---------------|
| • Structural Steel                | AWS CODE D1.1 |
| • Fuel System Piping              | ANSI B31.3    |
| • Lube Oil System Piping          | ANSI B31.3    |
| • Hydraulic Startup System Piping | ANSI B31.3    |

All welders will be required to provide certification of their qualification to the appropriate standard. Each welder's certified qualifications will be reviewed and approved by the welding inspector prior to the welder's beginning work on the project. Applicable welding procedure specifications (WPS) and Procedure Qualification Reports (PQRs) will be required. All reports and certifications will be in accordance with ASME Section IX Article II.

## **VII. AREA DESIGNATION**

Areas where combustible fluids, gases or vapors might be present shall be classified as hazardous areas or hot areas. Guidelines for welding in these areas will be drawn from ANSI Z49.1. Areas designated as safe areas will be those areas on site remote from hazardous areas and where no contact with combustible fluids, gases and vapors are present. Welding in these safe areas, as well as on-site welding fabrication, will be subject to the same standards

and codes listed in the previous paragraphs. The welding inspector shall designate an area classification for the project.

## **VIII. MATERIAL TEST REPORTS**

All carbon steel piping and flanges will be supplied with traceable material test reports (MTRs) as well as documentation certifying that the material is per specification.

All piping and flanges connected to the GE 7EA skid will be 304 or 304L seamless stainless steel. Traceable material test reports (MTRs) will be required on all stainless steel piping and flanges.

## **IX. SUB-SYSTEMS MECHANICAL TESTS**

The test requirements for the various tasks on the project are defined in the following paragraphs. Tests are defined in this case to be "system" centered, i.e., hydrostatic tests, vacuum tests, etc., versus inspections which are "component" centered. All tests shall be performed in the presence of a QA/QC inspector or his designate. All tests shall be documented with a written test report. The test report shall include a description of the test, the item or items tested, the procedure used, the date and time of the test and the test results. All test documentation shall be signed by the inspector.

### **A. Fuel System Tests**

All fuel system piping shall be subjected to hydrostatic leak testing to 1.5 times the design pressure. Non-pipe components of the system shall be isolated from the test. The hydrostatic leak test pressure shall be held for a minimum of 1 Hour and then reduced in accordance with ANSI B31.3 to conduct examination for leakage. Pneumatic tests on the PE or RTR may be substituted at 1.2 times design pressure.

### **B. Lube Oil System Tests**

All Lube Oil System piping shall be subjected to hydrostatic leak testing to 1.5 times the design pressure. Non-pipe components of the system shall be isolated from the test. The hydrostatic leak test pressure shall be held for a minimum of 1 Hour and then reduced in accordance with ANSI B31.3.

### **C. Hydraulic Starter System Tests**

All Hydraulic Starter System piping will be subjected to hydrostatic leak testing to 1.5 times the design pressure. Non-Pipe components of the system shall be isolated from the test. The hydrostatic leak test pressure shall be held for a minimum of 1 Hour and then reduced in accordance with ANSI B31.3.



**D. Process Water System Tests**

All metallic process water system piping will be leak service tested prior to commissioning. The piping systems under test will be brought up to Normal Operating Pressure and this pressure will be held for 10 minutes or as long as it takes to check each joint or fitting on the line under test. Test shall be conducted in accordance with ANSI B31.3 to conduct examination for leakage. Piping Systems which will be tested in this manner are the following:

- Cooling Water Systems (New Piping)
- Oily Water Piping

**E. Instrument Air System Leak Tests**

Instrument air piping systems will be subjected to a Pneumatic leak test following installation. Pressures will be raised to Normal Operating Pressures levels for each system and held for a minimum of 10 minutes.

**X. SPECIFIC TESTS – ELECTRICAL****A. Ground Grid Integrity Test**

The new installed grounding cables/rods will be attached to the existing system. Installed Ground Grid will be tested using a suitable multimeter to measure integrity prior to startup. Continuity and resistance will be confirmed for the new installed cables/rods. The readings will be recorded for record.

**B. Cable Insulation Testing - Megger**

All 600 Volt and above wire and cable to be used on this project will undergo an insulation test or tests to ensure cable is suitable for intended usage and has structural integrity for installation. All low voltage cables, below 600 volts, will be tested for continuity prior to being energized.

All medium and high voltage cable and wire will undergo Megger testing. Cables will be tested to levels established not to exceed the rated voltage of the cables. Megger testing will be performed with a calibrated test instrument certified to national standards.

The results will be recorded and maintained for record. A cable failing a Megger test will be tagged, segregated and removed from the job site.

**C. Cable Insulation Testing - Hi Potential Test**

Medium and high voltage cables will undergo Hi-Potential testing to detect any insulation breakdown in these cables.

Testing will be accomplished with a calibrated instrument certified to national standards. Results will be recorded and maintained for record.

#### **D. Cable and Conduit Installation - Inspections**

All cable, conduit and associated fittings will be checked to ensure compliance to specifications developed for this project. Conduit, fittings and cable installation will be monitored during construction to ensure compliance to NEC codes.

#### **E. Point to Point Testing**

All installed cables shall be point-to-point tested prior to being energized. The point-to-point test shall confirm cables are installed as designed and phased properly.

#### **F. Switchgear, Motor Control Centers, Breakers, and other Electrical Components, Instrumentation**

All switchgear, motor control centers, breakers and other electrical components, will be inspected and tested prior to and following installation. Specific test procedures will be developed for each major piece of equipment to be installed. Electrical components will be inspected prior to installation and, in most cases, will be tested as part of a larger sub-system. Instrumentation will be inspected prior to installation and calibrated following installation. Instrumentation will be tested as part of a larger sub-system.

### **XI. FACTORY ACCEPTANCE TESTS / INSPECTIONS**

The Client has the right to request the contractor an inspection of the equipment and witness all factory tests prior to shipment to the Project site. Tests will be undertaken at the manufacturer or fabricator's facility prior to being shipped to site.

Records of tests / inspections will be recorded and maintained for record. No sub-system or component will be installed until the successful completion of tests / inspections is achieved, or unless written release by the Manager is obtained.

### **XII. STARTUP TESTING AND COMMISSIONING**

Startup testing and commissioning will involve integration of all sub-systems into a complete system-wide test of operation. Testing will involve operation of all sub-systems listed below:

- Process Water Systems – Raw Water Supply System and Firewater System
- Fuel Gas Delivery System
- Gas Turbine Startup
- Gas Turbine Electrical Transmission
- Breaker Operation
- Protective Relays, Breaker Testing



### **XIII. REPORTS**

A copy of all inspection and test reports shall be maintained in a file at the project site. These reports shall be made available for review and reference as may be required throughout the project. The original copies of all inspection and test reports shall be forwarded periodically to the Quality Assurance Manager for review and safekeeping. Quality related problems that cannot be readily corrected at the project site will be immediately referred to the Quality Assurance Manager for resolution.

---

## **Section 10.0 Exceptions and Clarifications**

For clarification of the project the following exceptions and assumptions are stated:

### **10.1 The Scope of Supply of this document does not include the following outlined items:**

- Real estate property on which the Power Project is to be sited.
- Local, state, and/or government taxes associated with the Owner's corporations.
- Local, state, and/or government taxes associated with the Contractor furnished equipment.
- Any site environmental cleanup or modifications to site. **Contractor is not responsible for the removal and disposal of any existing hazardous waste on or near the site. This would include but not be limited to PCB's (Polychlorinated biphenyls), Asbestos, or any other hazardous waste either above ground or buried under ground.**
- Environmental permits. (Note: Contractor will assist in obtaining all permits where applicable.)
- Fuel gas for blow down, flushing, commissioning, start-up, and operation.
- Supply of Owner furnished items as outlined in Section 2.0 of this Proposal.
- Operating spares. (Contractor will submit a list of recommended spare parts.)
- Interconnect, integration, and compatibility with EDC's existing SCADA system
- Fiber optic cable detection system for unauthorized personnel located adjacent to perimeter fencing
- Contractor is not furnishing custody transfer fuel gas metering system. (This will be furnished and installed by the fuel gas supplier)

### **10.2 This proposal is also based on the following assumptions:**

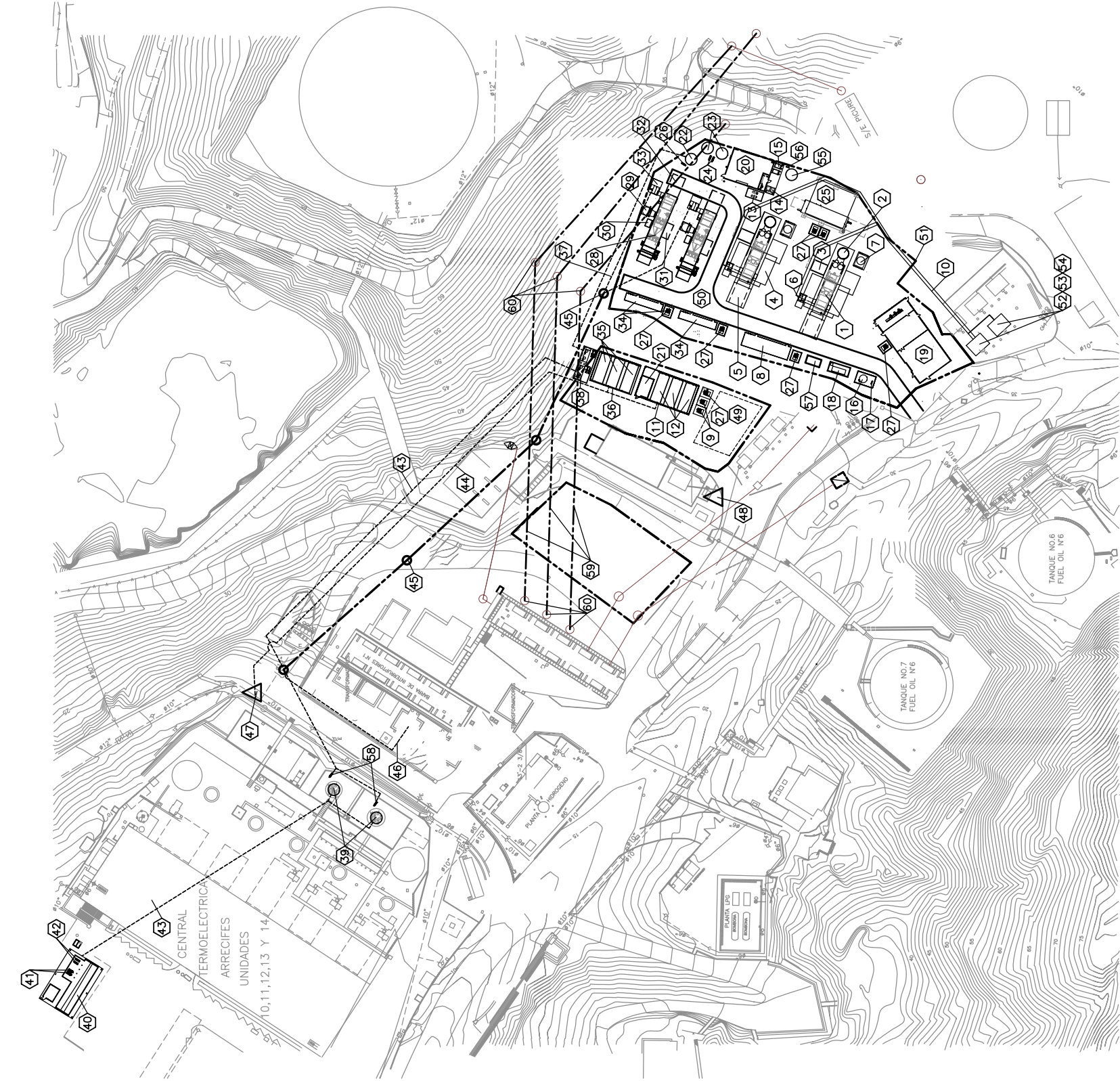
- Owner to supply to Contractor or receive the items outlined in Section 2.16
- Owner will provide complete site for use as described in the TSD and associated drawings.

- Contractor to apply for local county or state construction permit. (Owner will assist as required.)
- Contractor to furnish and install “first fill” lubricants and chemicals for the plant.
- Contractor will provide soil borings to be utilized for site design.
- Owner to provide site survey as necessary
- Owner to provide fuel for plant commissioning and start-up.
- Owner to provide rights-of-way for roadways, entrances, pipeline, and transmission line to the Power Project.
- Performance guarantees, administration of warranty conditions will be discussed and agreed upon and inserted into the appropriate sections of this document at contract signing.
- Contractor will transfer software licenses to the Owner at the completion of the project. This will include the license documentation passwords and keys. It will be the responsibility of the owner to maintain these licensing articles for the time when the software needs to be reinstalled.
- The Contractor supplied DCS shall allow for system expansion through the addition of controllers, operator stations in the control panels, process I/O systems and / or process controllers while the equipment associated with the controller/computer are in manual mode. Modifications can be preformed while the Power Plant is operational and the equipment in question is in manual mode. Proper safety precautions must be adhered to. “Tag out” procedures may be required.
- Operator stations in the control room can be expanded while in remote mode and the Power Plant is operational.
- Various vendor supplied PLCs for the major equipment will use either function block or ladder logic programming. The Balance of Plant PLC will use ladder logic programming. The Gas Turbines will utilize a GE designed control system.

## **Section 11.0 Drawings**

Please find on the following pages the following preliminary project drawings.

Overview Site Plan	10-001 Sh 1
General Arrangement Plot Plan	10-002 Sh 1
Process Flow Diagram	50-001 Sh 1
Process Flow Diagram	50-001 Sh 2
Process Flow Diagram	50-001 Sh 3
Process Flow Diagram	50-001 Sh 4
Generator One Line Diagram	60-001 Sh 1
Generator One Line Diagram	60-001 Sh 2
One Line Diagram	60-003 Sh 1
One Line Diagram	60-004 Sh 1
One Line Diagram	60-004 Sh 2
One Line Diagram	60-004 Sh 3
One Line Diagram	60-004 Sh 4



LEGEND:

- 1

LM-6000 GAS TURBINE GENERATOR.
- 2

LM-6000 EXHAUST STACK.
- 3

LM-6000 AUXILIARY SKID.
- 4

LM-6000 TURBINE REMOVAL.
- 5

LM-6000 GENERATOR REMOVAL.
- 6

LM-6000 15 KV BREAKER.
- 7

LUBE OIL FIN FAN COOLER.
- 8

LM-6000 MODULAR CONTROL BUILDING.
- 9

AUXILIARY TRANSFORMER (4160 V).
- 10

LM-6000 OVERHEAD CABLE TRAY (CONNECTING FROM LM-6000 15 KV BREAKER TO LM-6000 GSUS).
- 11

LM-6000 GAS COMPRESSOR BUILDING & SHED.
- 12

LM-6000 FUEL GAS COMPRESSORS WITH FIN FANS ON TOPS.
- 13

FUEL GAS/FILTER SKID.
- 14

SPRINT SKID.
- 15

WATER INJECTION SKID (LIQUID FUEL).
- 16

OILY WASTE STORAGE TANK.
- 17

OILY WASTE FORWARDING PUMP.
- 18

OILY WATER SEPARATOR.
- 19

OFFICES/CONTROL BUILDING.
- 20

DEMIN WATER TREATMENT BUILDING.
- 21

MCC ROOM.
- 22

TREATED LIQUID FUEL TANK (21,000 GALS).
- 23

DEMIN WATER TANK (2-21,000 GAL EACH).
- 24

DEMIN WATER FORWARDING PUMPS.
- 25

4000 TON CHILLER PACKAGE (OPTIONAL).
- 26

LIQUID FUEL FORWARDING PUMP.
- 27

AUXILIARY TRANSFORMERS (480 V).
- 28

LM-2500 GAS TURBINE GENERATOR.
- 29

LM-2500 EXHAUST STACK.
- 30

LM-2500 AUXILIARY SKID.
- 31

LM-2500 TURBINE REMOVAL.
- 32

LM-2500 GENERATOR REMOVAL.
- 33

LM-2500 15 KV BREAKER.
- 34

LM-2500 MODULAR CONTROL BUILDING.
- 35

LM-2500 GAS COMPRESSOR SHED.
- 36

LM-2500 FUEL GAS COMPRESSORS WITH FIN FANS ON TOP.
- 37

LM-2500 UNDER GROUND CABLE (CONNECTING FROM LM-2500 15 KV BREAKER TO LM-2500 GSU).
- 38

CENTRIFUGE PACKAGE (SUPPLIED BY OWNER).
- 39

RAW LIQUID FUEL TANK (2-21,000 GAL EACH).
- 40

LIQUID FUEL UNLOADING AREA.
- 41

LIQUID FUEL OFF LOAD PUMP.
- 42

LIQUID FUEL TRANSFER PUMP.
- 43

UNDER GROUND DIESEL PIPING LINE.
- 44

UNDER GROUND NATURAL GAS PIPING LINE.
- 45

TRANSMISSION TANGENT POLE.
- 46

UNDER GROUND CABLE (CONNECTING FROM TANGENT POLE TO LM-2500 GSU).
- 47

NATURAL GAS SUPPLIED BY OWNER TIE POINT.
- 48

RAW WATER SUPPLIED BY OWNER TIE POINT.
- 49

EXISTING SUBSTATION AREA.
- 50

ROAD.
- 51

PROPERTY BOUNDARY CONCRETE RETAINING WALL.
- 52

LM-6000 GSU (SUPPLIED BY OWNER-TWO REQUIRED).
- 53

LM-6000 DISCONNECT SWITCH (NOT SHOWN-SUPPLIED BY OWNER-TWO REQUIRED).
- 54

LM-6000 69 KV BREAKER (NOT SHOWN-SUPPLIED BY OWNER-TWO REQUIRED).
- 55

RAW WATER TANK (21,000 GALS).
- 56

RAW WATER FORWARDING PUMP.
- 57

EMERGENCY BLACK START (SUPPLIED BY OWNER).
- 58

RAW LIQUID FUEL FORWARDING PUMP.
- 59

NEW 69 KV OVERHEAD TRANSMISSION LINE.
- 60

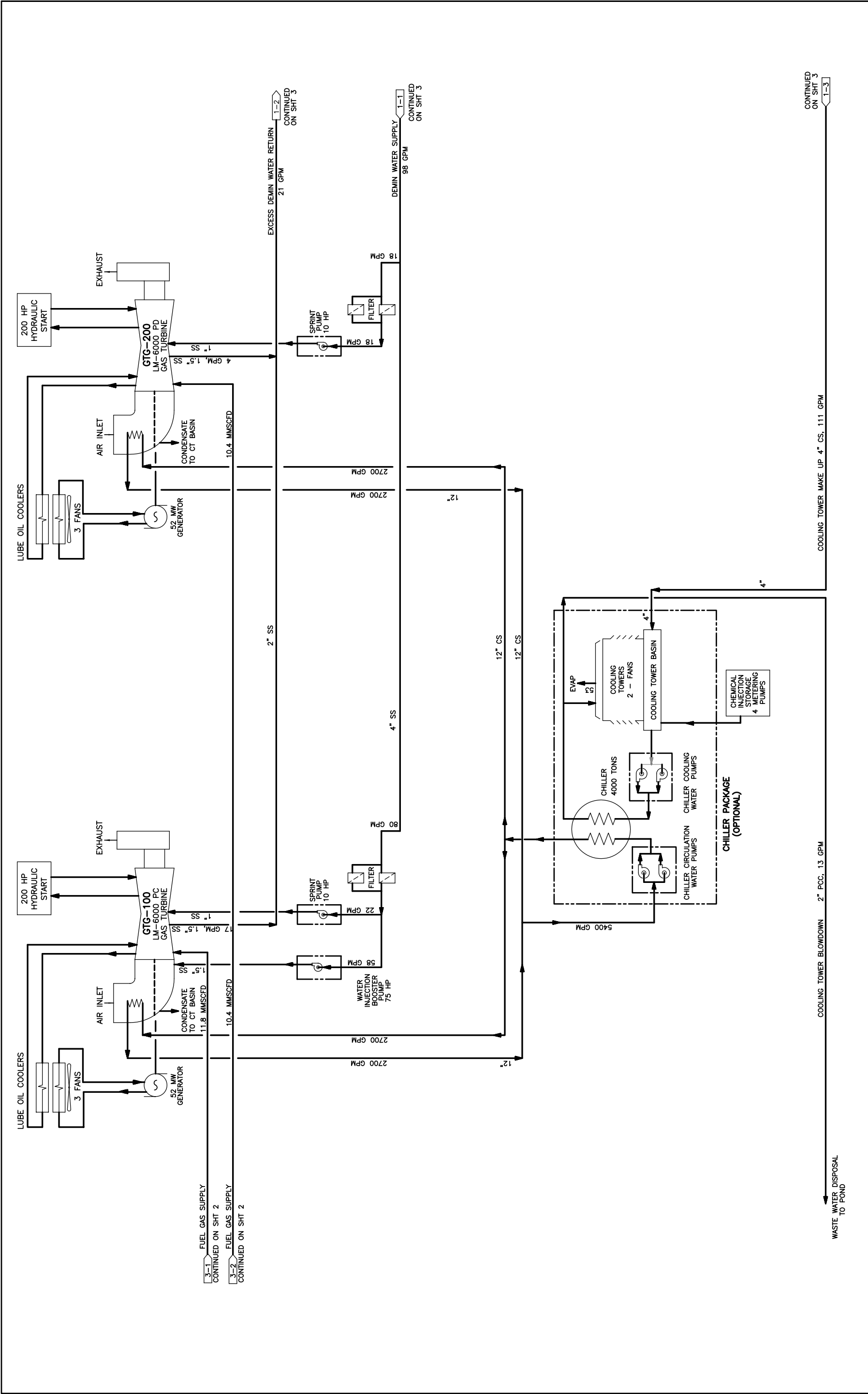
NEW TRANSMISSION POLE LOCATION.




GRAPHIC SCALE

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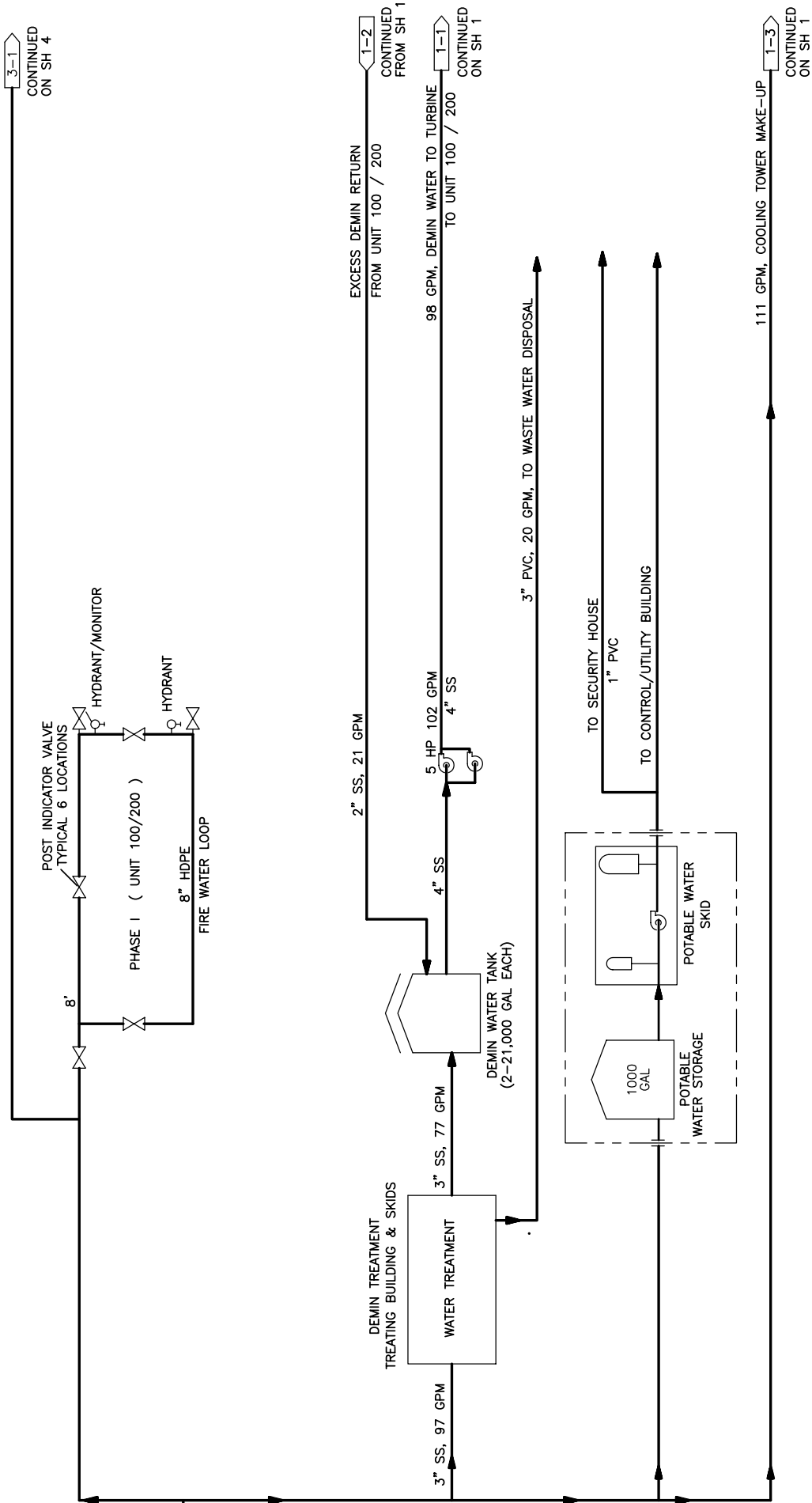


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<div><div></div><div><b>ProEnergy</b> EPC SERVICES</div></div>												<div><div><b>907 SOUTH DETROIT AVE</b> <b>SUITE 140</b> <b>TULSA, OKLAHOMA 74120</b> <b>OFFICE</b> <b>FAX</b> <b>www.proenergyservices.com</b></div><div><b>ProEnergy EPC Services, LLC</b> <b>PROCESS FLOW DIAGRAM</b> <b>TWO (2) LM-6000 GENERATOR UNITS</b> <b>TACOA POWER PLANT</b></div><div><small>TACOA</small> JOB NO. <b>T9003—A</b> &amp; <b>B</b> DWG NO. <b>50—010</b> REV <b>1</b> VENEZUELA <b>A</b></div></div>											



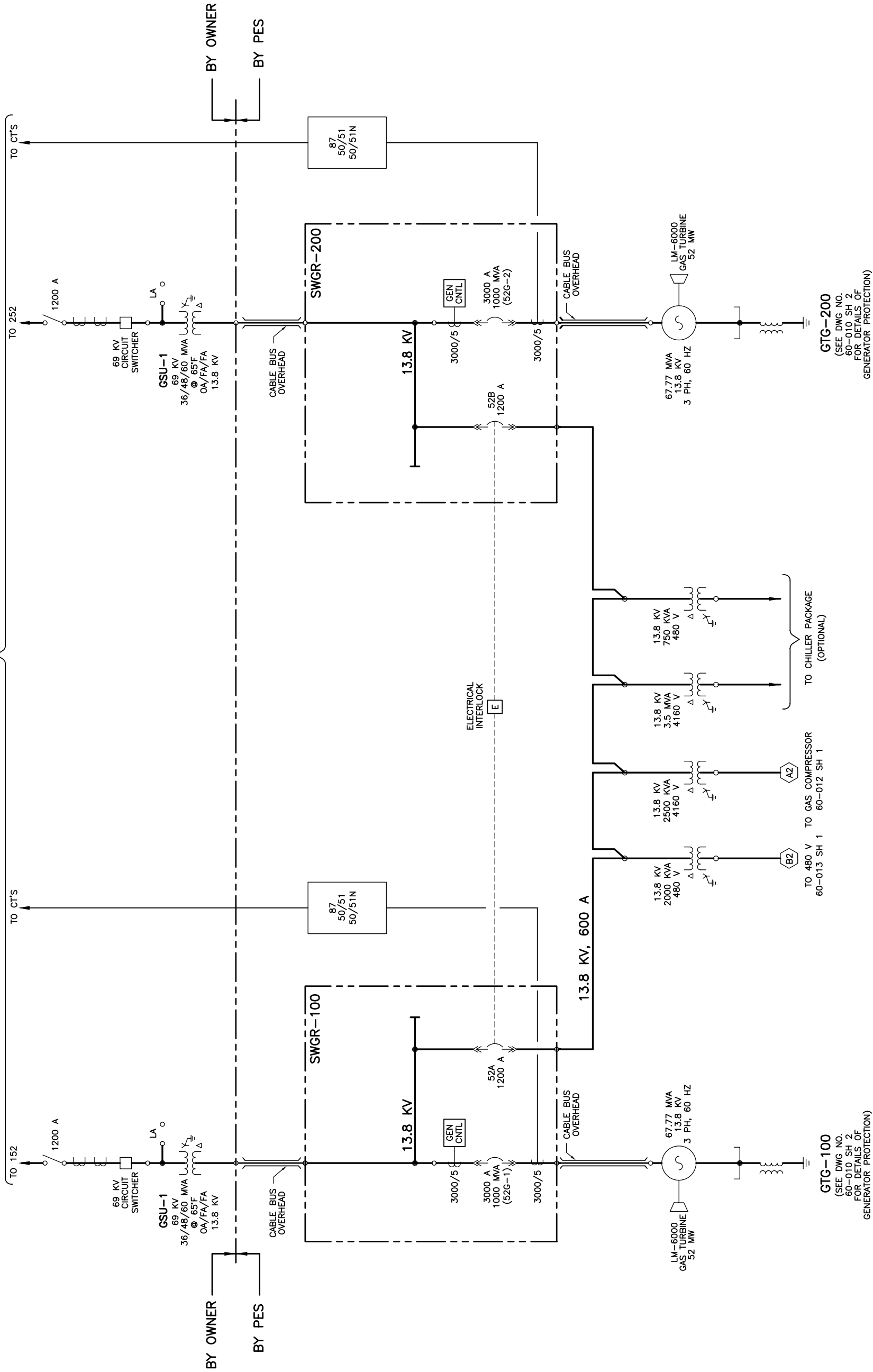
RAW &  
FIRE WATER  
SUPPLIED BY  
OWNER

FROM OWNER FIRE WATER SYSTEM



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**GTG-200**  
(SEE DWG NO.  
60-010 SH 2  
FOR DETAILS OF  
GENERATOR PROTECTION)

**GTG-100**  
(SEE DWG NO.  
60-010 SH 2  
FOR DETAILS OF  
GENERATOR PROTECTION)

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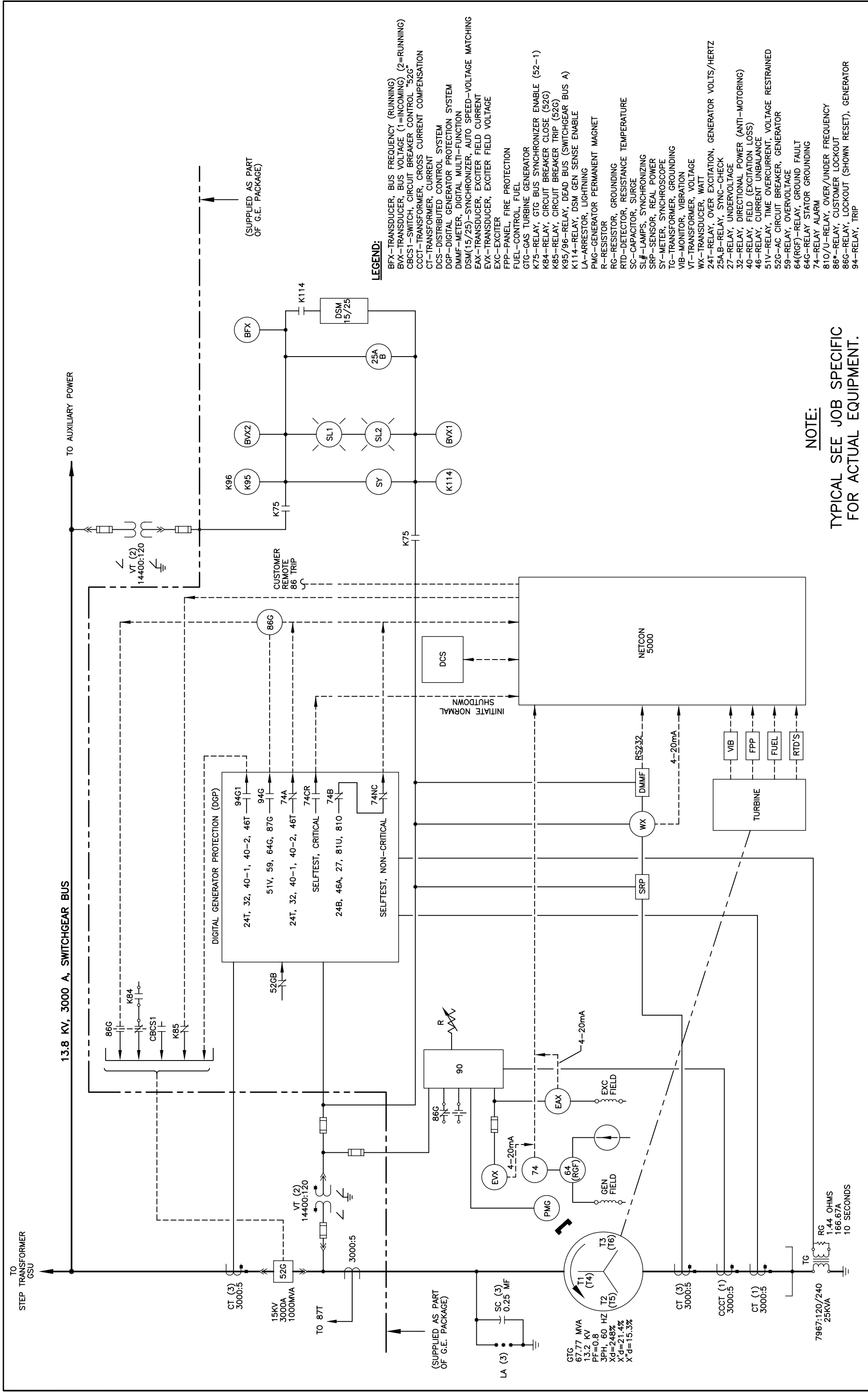


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**ProEnergy EPC Services, LLC**

ONE LINE DIAGRAM  
TWO (2) LM-6000 GENERATOR UNITS  
TACOA POWER PLANT

TACOA	JOB. NO.	DWG NO.	SH NO.	REV	VENEZUELA
	T9003-A & B	60-010	1	A	



NOTE:

TYPICAL SEE JOB SPECIFIC  
FOR ACTUAL EQUIPMENT.



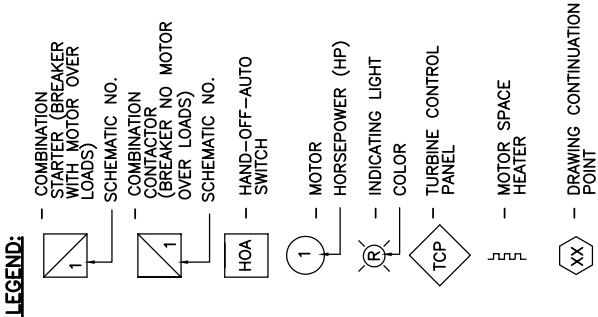
**907 SOUTH DETROIT AVE.  
SUITE 1140  
TULSA, OKLAHOMA 74120  
OFFICE  
FAX  
[www.proenergyservices.com](http://www.proenergyservices.com)**


**FAX**  
**www.proenergyservices.com**

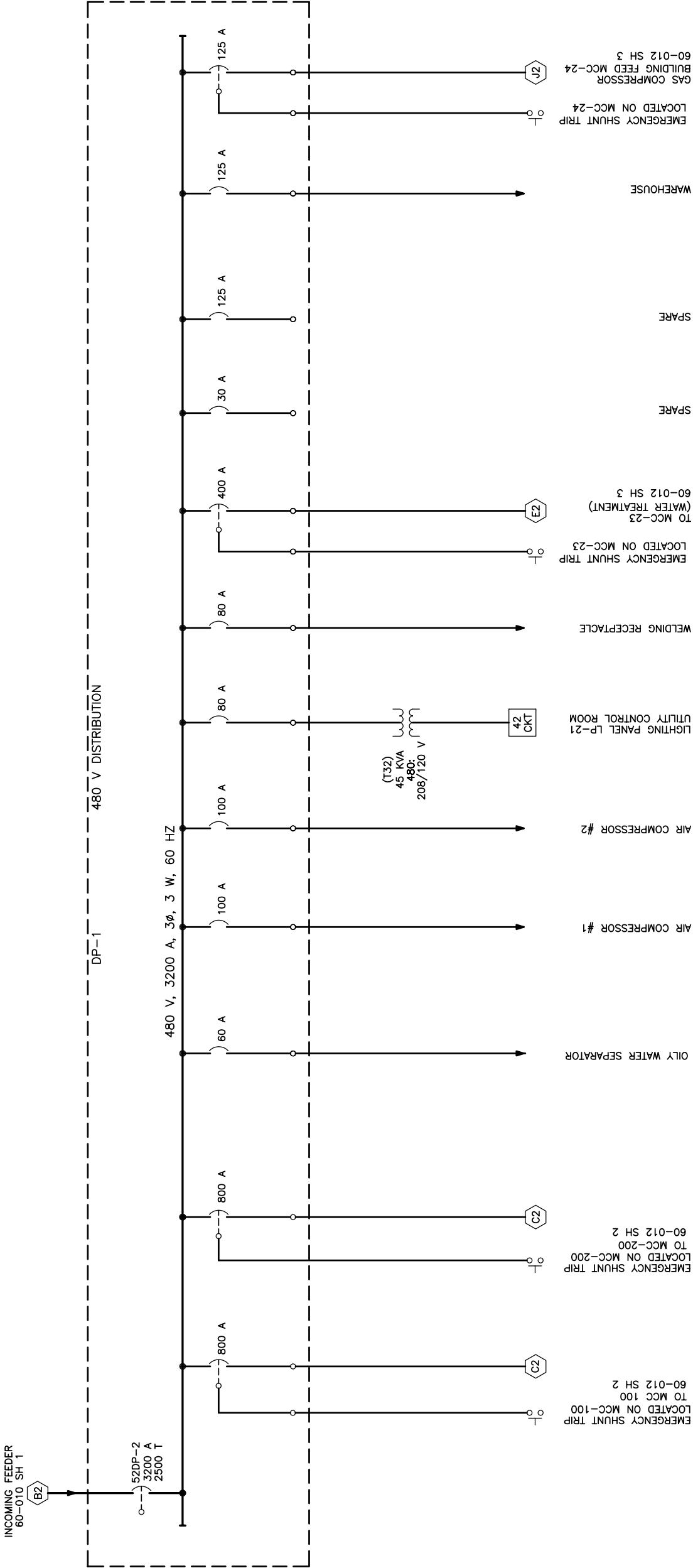
***ProEnergy EPC Services, LLC***

ONE LINE DIAGRAM  
TYPICAL LM-6000 PROTECTION  
TACOA POWER PLANT

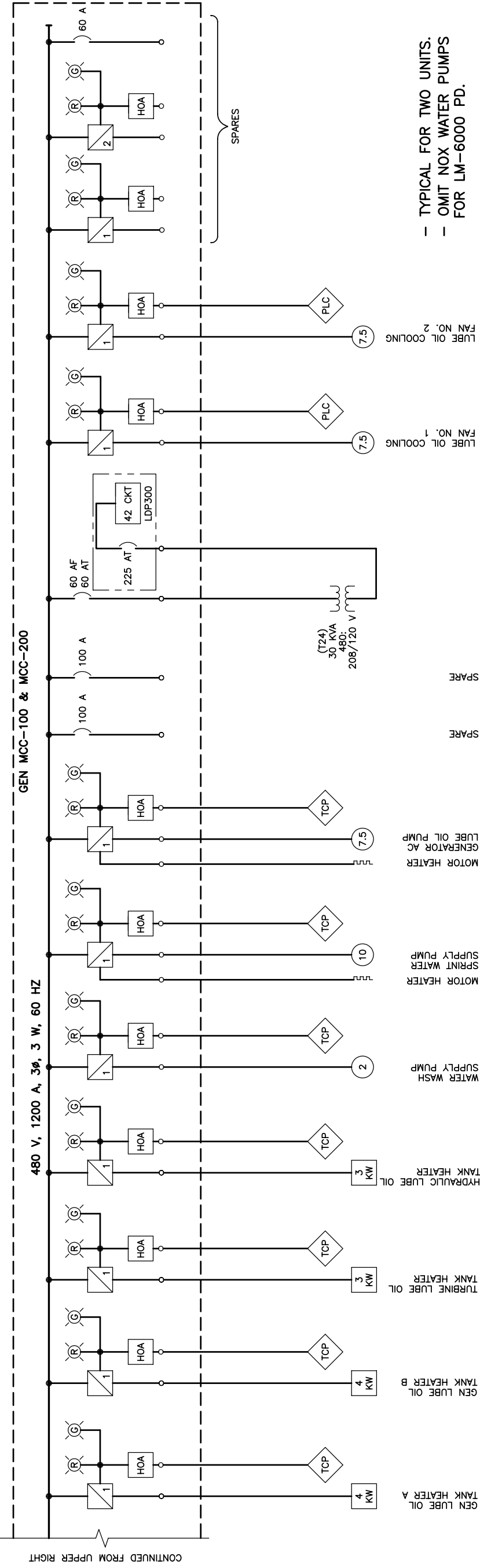
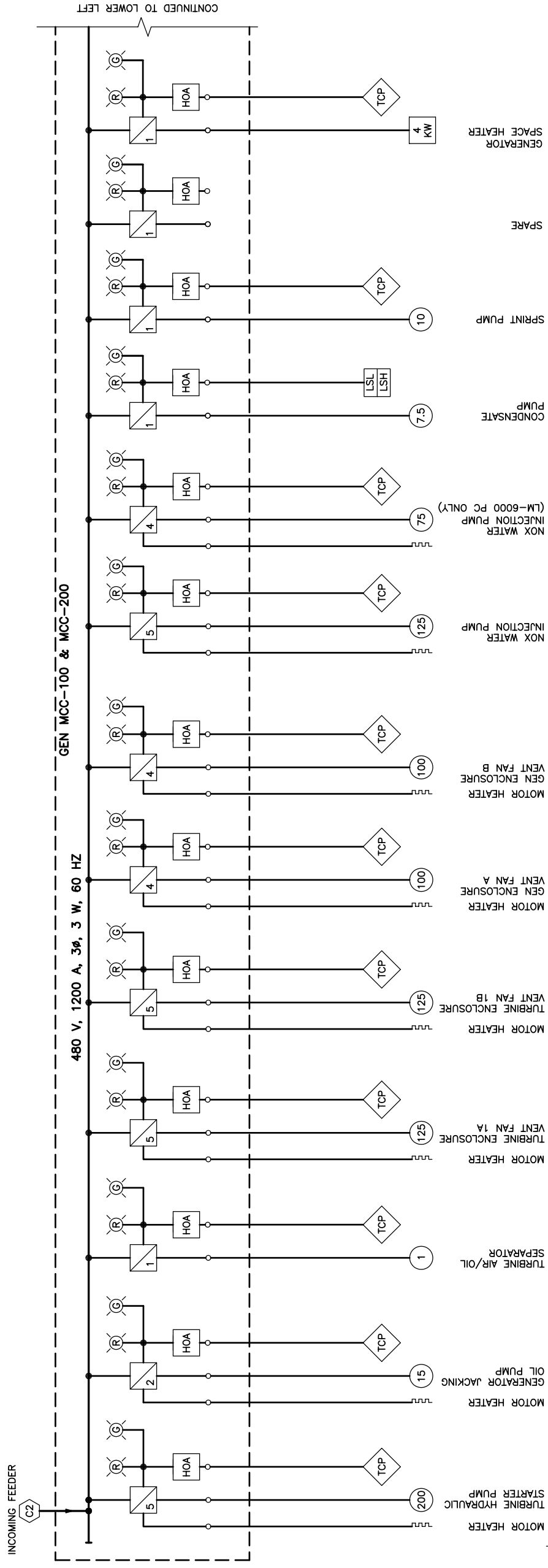
TACOA	JOB. NO.	DWG NO.	SH NO.	REV
	T9003-A & B	60-010	2	A



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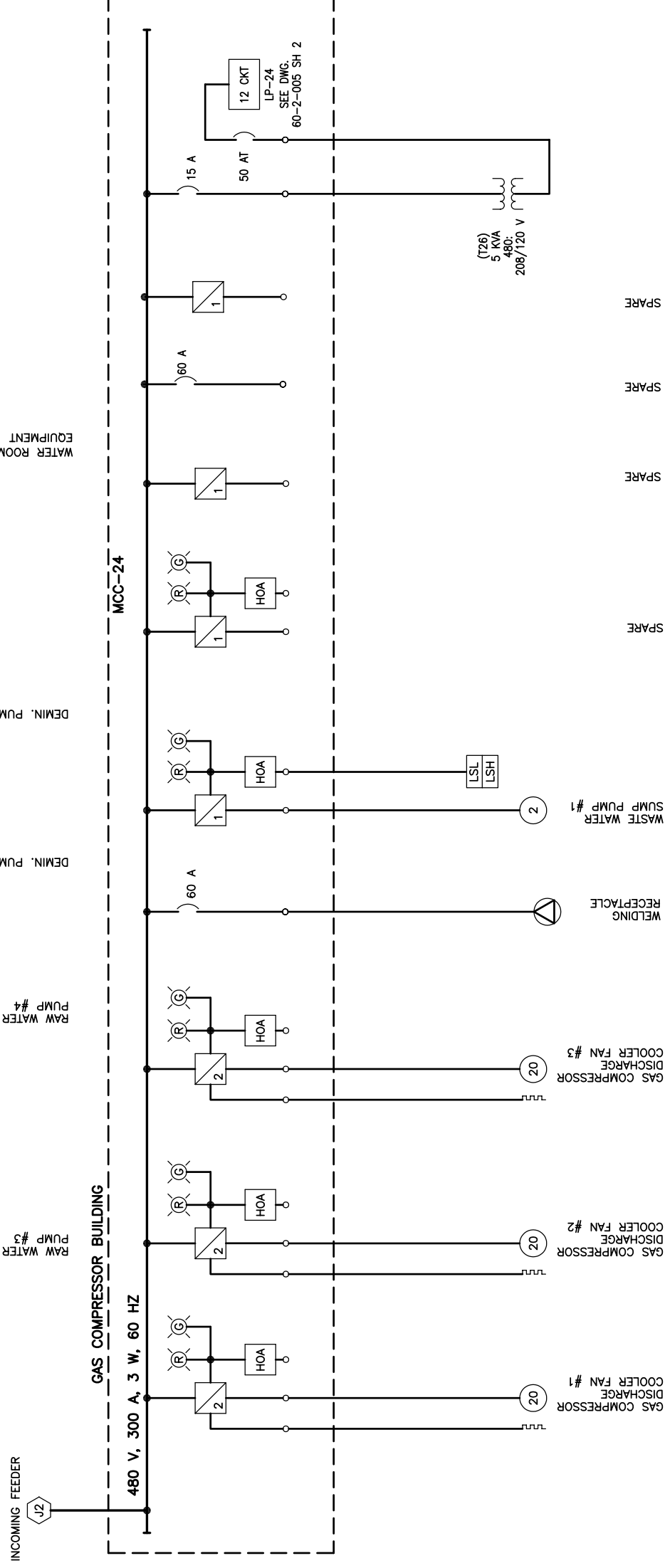
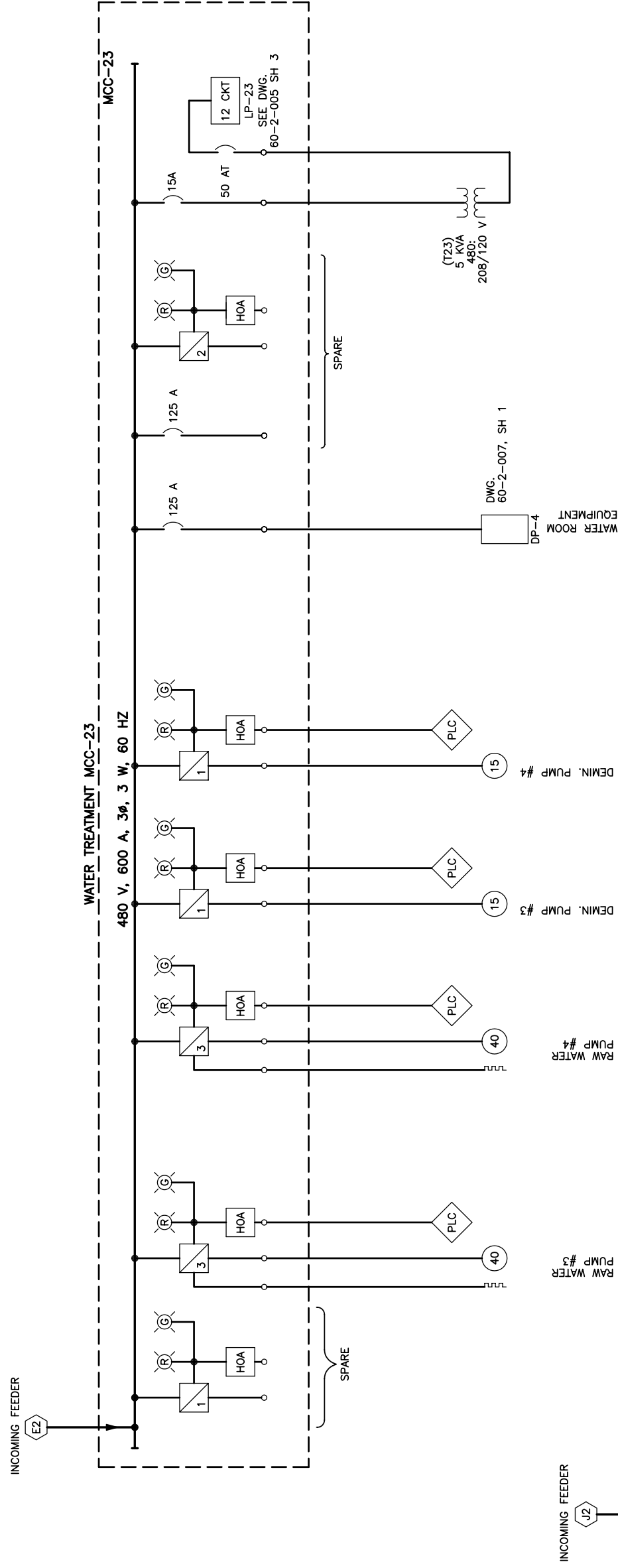


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[illegible]



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**Section 12.0 Appendix (Later)**

- 12.1 Site Meteorological Data (By Owner)**
- 12.2 Site Location Map (By Owner)**
- 12.3 Raw Water Analysis (By Owner)**
- 12.4 Parasitic Loads (Later)**
- 12.5 Fuel Gas Specification (Later)**
- 12.6 Demin Water Specifications (Later)**
- 12.7 Soils Report (BY Owner)**
- 12.8 Major Equipment Specifications (Later)**
  - 12.8.1 LM6000 Gas Turbine Generator**
  - 12.8.2 Fuel Gas Compressors**
  - 12.8.3 Water Treatment System**
  - 12.8.4 Liquid Fuel Centrifuge**
  - 12.8.5 Oily Water Separator**
  - 12.8.6 Instrument Air Compressor**
  - 12.8.7 Plant DCS System (By ProEnergy EPC)**