

# TECHNICAL SCOPE DOCUMENT

Presented To:

**CARSON BAY ENERGY HOLDINGS**

For

**GE Frame 7FA 470 MW  
Warthen, Georgia Power Plant**

*By*



Proposal T-9030  
July 31, 2009

**This document is privileged and contains confidential information intended for use only by  
Carson Bay**

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**Carson Bay Energy Holdings  
7FA Simple Cycle Plant  
Technical Scope Document**

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**Section 1.0 Introduction**

ProEnergy EPC Services (PES) is pleased to submit this Proposal Technical Scope Document to Carson Bay Energy Holdings, LLC for the furnishing and installation of three (3) natural gas fueled General Electric Frame 7FA Gas Turbine Generators with associated 500 KV Generator Step Up Transformers and other Balance of Plant equipment.

This Technical Scope Document is being forwarded with as much information as possible that could be assembled in the short time. Since the Gas Turbine Generators are "on the shelf", this project can be engineered, designed, constructed and commissioned within a 16-18 month period from the receipt of an executed EPC Contract and receipt of a down payment. This assumes Carson Bay Holdings, LLC has an existing Air Permit for the site.

**THIS DOCUMENT IS CONFIDENTIAL. IT IS DESIGNED AND INTENDED FOR CARSON BAY ENERGY HOLDINGS' USE. THIS DOCUMENT IS FOR THE SOLE PURPOSE OF EVALUATING PROENERGY EPC SERVICES' PROPOSAL FOR THE GE FRAME 7FA PROJECT.**

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## **2.0 Scope of Work**

### **2.1 Power Plant**

#### **2.1.1 Major Mechanical Equipment**

2.1.1.1 The Contractor will purchase and sell to the Owners three (3) each GE Frame 7F gas fueled gas turbine generator packages. The Contractor will remove these units from the existing storage location and transport them to the Warthen, GA. site for installation. This transportation is excluded from our Fixed Price proposal, but would be provided on a cost plus 10% mark-up basis.

#### **2.1.2 Balance of Plant**

The Contractor proposes to furnish the Balance of Plant equipment and material which comprises:

- Pre-Engineered Metal Office/Control Building and a Water Treatment Building
- Mechanical Equipment including lube oil cooling water system, fuel gas system, firewater, inlet air evap cooling, water treatment, instrument air, and oily water separator.
- Three (3) each Frame 7FA Exhaust Stacks with by-pass diverter valve, silencers and emissions ports.
- Electrical Equipment including 18 KV isolated phase bus duct, 18KV/500KV Generator Step up Transformers, 18KV, 4.16 KV and 480 V Auxiliary Transformers, 4.16 KV and 480 V MCCs and switchgear, 120/208 System, and 125 V DC System.
- Instrumentation and Control Systems including plant instrumentation.

The Balance of Plant installation also includes:

- Project Management, Engineering, Management of Subcontractors (Civil, Mechanical and Electrical/Instrumentation), QA/QC, Safety, Erection, Start-up, Commissioning and Operator Training.
- Plant testing according to ASME requirements, confirming performance, emissions, reliability, and parasitic loads.

##### **2.1.2.1 Balance of Plant Electrical**

2.1.2.2 5 KV Class Switchgear – The 5 KV shall be weatherproof NEMA 3 non-walk-in type. It will be metal clad type with power circuit breakers, horizontal draw out type vacuum break to the latest ANSI standards. No lift truck or dolly is needed to insert or remove

the breakers. There shall be eight feeder breakers rated 1200 amps for station service power distribution. The equipment shall include current transformers and potential transformers, protective relays, and metering. The equipment shall be as manufactured by General Electric or Siemens.

2.1.2.3 Auxiliary Transformer – The auxiliary transformers shall be rated for 1500 KVA, 4160 V primary and 480 volt wye secondary. The transformers shall be pad mount design with enclosed bushings. It shall be fitted with liquid level and oil temperature indicators. The unit shall be as manufactured by Alstom.

2.1.2.4 Integrated Turbine Control/Electrical Building (PEECC)– The Control/Electrical building shall be weatherproof design each housing equipment as indicated below. It shall include interior lighting, air conditioning, ventilation and receptacles. The units will be skid mounted and arranged for top entry of incoming and outgoing circuits. They will house the following equipment which will be prewired with the necessary connections between the included equipment within each building

- Equipment included with each GT Package:
  - Turbine Control Panel (with CRT and metering)
  - Generator Protection Panel
  - 18KV Iso Phase Bus
  - 18KV Generator Breaker
  - 18KV/4.16KV 10MVA Aux. Transformer
  - 4.160 KV Switchgear
  - 4.160 KV/480V 1500 KVA Aux. Transformer
  - 480 V MCCs GTG
  - 480 V Distribution Panels GTG
  - Generator Starting System
  - Generator Exciter System
- 480 Volt BOP Distribution Panels and MCCs
- Batteries and Chargers
- Lighting transformers
- Balance of Plant Programmable Logic Controller

2.1.2.5 480 Volt Distribution Board – The 480 Volt Distribution Board shall contain a main 2000 amp electrically operated breaker. Feeder breakers will be provided to distribute 480 volt power to the various loads. The design shall be NEMA 1 indoor construction with front connection of all circuits. The equipment shall be equal to Siemens type SB1 switchboard

2.1.2.6 480 Volt Motor Control Centers – The Motor Control Centers shall be of NEMA 1 Class B construction with integral breaker and combination motor starters. All control circuits are pre-wired to terminal blocks at each unit. Each unit is of drawout construction that presents a dead front when the access door is opened. Each starter unit will be fitted with a red running light and a green off light and a “Hand-Off-Auto” selector switch. Auxiliary contacts are provided on each motor starter for remote indication. The bus

shall be rated at 42,000 amps. Interrupting. The unit will be as manufactured by General Electric or Siemens.

2.1.2.7 480/120/208 V Auxiliary Transformers – The low voltage transformers shall be indoor, floor mounted, single and three phase as required for lighting, receptacles, control and low voltage power.

2.1.2.8 125 Volt DC Battery Systems – Two (2) 125 VDC Battery systems will be supplied for the substation and for the 5 KV switchgear equipment. Batteries shall be sealed lead-calcium type. Manufacturer shall be equal to Deka by East Penn. The systems shall provide reliable power for the 5 KV switchgear and the switchyard. Size shall provide sufficient power for one emergency with sufficient reserve to trip and recharge all the breakers.

2.1.2.9 Gas Turbine Control Panel (TCP) - PES will connect the Gas Turbine Control Panel (TCP) and Generator Control Panel (GCP) to the plant DCS System located in the central control room located in the Operations, Office and Maintenance Building.

### **2.1.3 Civil / Structural**

2.1.3.1 Site Preparation – The Contractor will perform final clearing and grubbing of the plant site to make ready for grading.

2.1.3.2 Site Grading – The Contractor will provide all site work and grading. Grades will be established to minimize the amount of earthwork required to construct the facilities. All areas disturbed during construction shall be graded to a smooth surface and covered with appropriate material as conditions require. Finish grading shall be performed to conform to the finished design elevations for surface drainage and to prepare the areas to receive the specified surface finishes.

2.1.3.3 Storm Water Drainage System – The Contractor will provide a storm water drainage system to collect all rainwater for the site. Storm water will be managed through use of swales, ditches, culverts and site grading to drainage locations away from the facility as shown on site grading plan. The storm water drainage system shall drain into the local storm drain roadway ditches.

All rain water collected from active areas that can potentially be contaminated by oil shall be routed through an oily water separator.

2.1.3.4 Process Waste Water – The Contractor shall route all process waste water to a designated disbursement point. The process waste water shall include:

- Water Treatment
- Cooling Tower
- Frame 7F
- Oily Water Separator

2.1.3.5 Fencing – Fencing will be a minimum of 8-foot high chain link fence with three (3) strands of barbed wire on top, including gates.

2.1.3.6 Plant Gravel, Roads, Paving, Parking, and Landscaping – The Contractor will provide for plant gravel, roads and parking.

#### 2.1.3.7 Concrete

Contractor is to provide concrete for foundations in accordance with the following section. Contractor to provide design and anchor bolts.

##### (1) Codes

Design of structural concrete will be in accordance with the American Concrete Institute (ACI) – “Building Code Requirements for Structural Concrete,” ACI 318, latest edition, and the UBC Code.

##### (2) Materials

Minimum concrete strength classes for various structures will be as stated.

Reinforcing bars will conform to ASTM A615, Grade C.

Welded wire fabric will conform to ASTM A185, using bright basic wire conforming to ASTM A82. Wires gauge No. 11 or smaller shall be galvanized.

Spiral reinforcement will conform to ASTM A82.

##### (3) Placing of Concrete

Contractor to provide forms, rebar and place Owner provided concrete for all foundations. Contractor will adhere to good and accepted practices in placing concrete generally as outlined:

##### (4) Placing Concrete:

Conform to ACI

Place within 60 minutes after mixing, except site weather conditions may extend the period to 90 minutes (maximum).

Place in horizontal layers not exceeding 20 inches.

Vibrate or spade concrete to produce solid mass without honeycomb or surface air bubbles.

##### (5) Curing Concrete:

Unless specified to be moist cured, cure with liquid membrane-forming compound conforming to ASTM C309, Type I. Apply according to manufacturers recommendations.



Apply curing compound to all exposed surfaces immediately after removing from or after finishing concrete.

Keep formwork wet until stripped.

Moist curing shall be used for surfaces that will receive a separate finish or coating.

(6) Testing

Contractor will test concrete and make test cylinders conforming to ASTM C31, C143, and C172. Owner will make a minimum of four test cylinders for each 150 cubic yards of concrete or fraction thereof, or every 5000 square feet of surface area for slabs and walls, for each day concrete is placed.

(7) Equipment Foundations

The types of foundations and piling, if required and allowable bearing values for soil and rock, will be as recommended by Contractor's Geotechnical Engineer in accordance with the Owner-provided final geotechnical report.

Design of foundations will be in accordance with ACI 318 and the UBC.

(8) Containment Basins

Containment basins will be provided around transformers and other equipment, which contain oil in case of rupture, spill, or leak. The basins shall be designed in accordance with the NFPA 850 and Factory Manual recommendations.

#### 2.1.3.8 Structural Steel

Contractor will furnish and install necessary structural steel including:

- Piping racks and supports
- Cable tray supports
- Walkways and platforms
- Grating and supports

Structural design will be in accordance with the applicable codes and standards.

(1) Wind and Seismic Loads

All structures, tanks, equipment anchorage, and piping and cable tray supports will be designed and installed to resist code-specified wind and seismic loads. Pipe supports shall also be designed for reactions due to pipe stress analyses and support degree of fixity.

(2) Codes

Design of structural and miscellaneous steel shall be in accordance with the 1997 Uniform Building Code (UBC), the American Institute of Steel Construction (AISC) "Specification for Structural Steel Buildings," latest edition and other applicable Codes and Standards.

#### **2.1.4 Buildings**

The following buildings will be supplied for the facility.

##### **2.1.4.1 Control/Office/Warehouse Building**

The building to be a prefabricated metal insulated building complete with 12-16 foot sidewalls and the following:

- ☐ Heating and air conditioning
- ☐ Fluorescent lighting fixtures
- ☐ Painted sheetrock walls
- ☐ Concrete Floors
- ☐ Toilets
- ☐ Kitchen
- ☐ Wooden interior doors
- ☐ Metal exterior doors

2.1.4.2 Water Treatment/Firewater Pump Building to be a prefabricated metal insulated building complete with 12 ft. sidewalls, heating and air conditioned electrical room and pump room.

#### **2.1.5 Mechanical Piping, Valves and Fittings**

Piping, Piping Installation and Piping Insulation - The piping for the facility will be fabricated and installed per the Process Piping Code, ANSI B31.3. All pipe welds are to be done by individuals certified to ASME Section IX. Piping materials will be provided according to the piping specifications that can be found in the Appendix, Section 12.9.

Oil, water, hydraulic pipe welds will also be performed in accordance with ASME. Acceptance criteria will be indicated in ANSI B31.3.

All underground carbon steel piping shall be wrapped or coated and cathodically protected. Carbon steel piping shall be jeepeed prior to cover. Cathodic protection will be

provided by the induced current method, which utilizes protective anodes, rectifier, and provides test points at strategic locations to monitor for potential corrosion.

## **2.2 Substation Equipment**

The following equipment items are included in the substation supply.

- 2.2.1 Three (3) Generator Step Up Transformers (GSU) rated at 500 KV 120/160/200 MVA OA/FA/FA at 55 degrees C. Supplied with current transformers on HV bushings and with station type lightning arrestors.

## Section 3.0 Equipment List

Material/Responsibility	Qty	Description
Contractor	3	GE Frame 7FA Gas Turbine Generators PEECC Building Inlet Air Filter Assembly with Evaporative Cooler Turbine and Generator Protection Panels Auxiliary Systems ISO phase bus – 8000 amp Generator Starting System Generator Exciter System 18KV/4.160 KV 10 MVA Aux. Transformer 4.16KV 1500 KVA Aux. Transformer 4.16KV Swgr. 480 V MCCs & Distribution Panels Gas Turbine Generator 24V Batteries and Associated Chargers Gas Turbine Generator L.O. Cooling system with (2) pumps - skid Lube Oil Cooler Water Fin Fans
	1 Lot	Gas Turbine Generator Technical Representatives
Balance of Plant	3	Exhaust Stacks with Diverter Valves
	3	Evap Cooling Systems for Gas Turbine Inlet Air System
	3	Cooling water circulation pump skids
	1	Fuel Gas Plant ESD Valve
	3	Fuel Gas Skids (regulator, coaleser, Filter)
	3	Fuel Gas Heater Skids
	1	RO Water Treatment system for Evap cooling
	1	200,000 gallon R.O. Water Storage Tank
	2	R.O. Water forwarding pumps
	1	300,000 gallon Raw Water / Firewater Storage Tank
	2	Raw water forwarding pumps
	1	Plant Firewater pump system including dist. headers, monitors, etc.
	1	Demin Water Treatment System for Turbine Water Wash
	1	21,000 gallon Demin Storage Tank
	1	Demin water forwarding pump skid with filters
	1	Oily water Separator
	1	10,000 gallon Waste Oil Storage Tank
	1	Waste Oil pump for off-loading to truck and removal
	1	240 SCFM Duplex Instrument Air Compressors with Filters, Dryers & Receiver
	3	Isophase 18 KV Bus Ducts
	3	4160V to 480 V 1500 KVA Auxiliary Transformers
	3	4160V to 480 V 1000 KVA Auxiliary Transformers
	1	4160 Volt Station Service Switchgear
	3	480 V MCCs for Gas Turbine Generators
	1	480 V Distribution Panel
	1	480 V Balance of Plant MCC
	1 Lot	BOP 480 V/120/208V Transformers, Distribution Panels, Lighting Panels
	1 Lot	Plant Ground Grid System expansion
	1	BOP DCS Control System expansion
	3	125 VDC Battery with Charger and Distribution Panels
	1	Auxiliary Electrical Building with MCCs and Controls and Pump Room
	1	Office, Control, Restrooms, and Maintenance-Warehouse Building
	1	Water Treatment Building
	1	Guard House



### Section 3.1 Substation Equipment List:

Material/Responsibility	Qty	Description
Contractor	3	18 KV/500 KV 200 MVA Main Step-up Transformers

## **Section 4.0 Design Basis**

### **4.1 Design Basis**

#### **Design Conditions**

Site Elevation	400 feet
Air Temperature, High	95° F
Air Temperature, Low	30° F
Maximum Wind Velocity	100 mph
Relative Humidity	45%
Seismic Zone	N/A
Fuel Gas Supply Pressure	800 psig minimum – PL
Fuel Consumption Rate per 7FA GTG	39.08 mmscfd
High Voltage Interconnect	GSU 500 KV High Voltage terminals
Raw Water Supply (Estimated)	130 gpm water wells by Owner
Water Usage per 7FA	25 gpm
Raw Water Storage	300,000 Gallons CS Tank
Instrument Air System	240 scfm by Contractor
Oily Water Separator	Oil and Water Waste – Truck disposal
Demin Water Treatment	10 gpm by Contractor
Demin Water Storage	21,000 gallons by Contractor
Inlet Air Evap Cooling R.O. Water	up to 75 gpm by Contractor

### **4.2 Interconnect Points**

Natural Gas at min. 450 psig	Owner to provide interconnection point at the Plant Battery Limits.
Plant Waste Water	Plant Battery Limits.
Plant Waste Oil	Plant Waste Oil Tank to Owner for Truck Removal
500 KV	Utility connect to HV side of GSUs
Telephone	Plant Battery Limits.
Raw Water Supply	Plant Battery Limits.
Sanitary Sewer	Plant Septic System by contractor
Raw Water Supply	Plant Battery Limits by Owner

## Section 5.0 Plant Performance

The auxiliaries include 750 kW fuel heater load for each GT.

<b>Design Conditions: 95°F; 45% RH; 400 ft</b>		
<b>GE 7241 FA DLN with Evap Cooling</b>		
<b>Fuel: Natural Gas</b>	<b>7FA</b>	<b>7FA</b>
	(1) Unit	(3) Units
Gross Power (kW)	159069	477206
Net LHV HR (BTU/kWh)	9677	9674
Net HHV HR (BTU/kWh)	10713	10711
Net Power (kW)	156519	469661
Misc. Auxiliaries (incl. fuel heaters) (kW)	1755	5160
Transformer losses (kW)	795	2386
Total Auxiliaries (kW)	2550	7546
Fuel usage (pph)	76120	228360
Fuel usage (MMSCFD)	39.08	117.24
Fuel Chemical HHV/LHV ratio	1.107	1.107
Evap Cooling water (pph)	12420	37260
Evap Cooling water (gpm)	24.84	74.52

**Section 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 Tests

### **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 HMIs, 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.

## **Section 8.0 Executive Project Schedule**

With today's delivery schedule, the Project can be commercial 16 – 18 months from Execution of an EPC Contract and receipt of a mutually agreed upon down payment.

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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.

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.

##### **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.

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**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**

- 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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- XII. START-UP TESTING AND COMMISSIONING
- XII. REPORTS

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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.

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**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).

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.

**C. Natural Gas Piping**

Piping from the supply source to the Fuel Filter/Separators will be Carbon Steel. The piping on the downstream side of the filter/separators 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**

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 B31.3. All Lube Oil system welds will undergo visual inspection or testing in accordance with ANSI B31.3. 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 B31.3. All Hydraulic system welds will undergo visual inspection or testing in accordance with ANSI B31.3. 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.

Raw Water System piping welds will be visually inspected.

**H. Process Water Systems**

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.

**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.

## **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 if schedule allows. Tests will be undertaken at the manufacturer or fabricator's facility prior to being shipped to site.

### **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



**Carson Bay Energy Holdings  
7FA Simple Cycle Plant  
Technical Scope Document**

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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.

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## **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.
- Environmental permits. (Note: Contractor will assist in obtaining all permits where applicable.)
- Local county or state construction permit. (Contractor will assist in obtaining.)
- 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.)

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

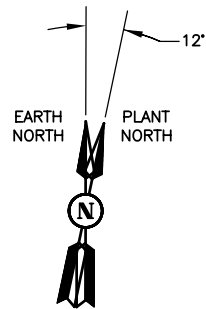
- Owner to supply to Contractor or receive the items outlined in Section 3.0
- Owner will provide all authority required to make the proposed utility interconnects.
- Owner will provide complete site for use as described in the TSD and associated drawings.
- Contractor to furnish and install "first fill" 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 custody transfer fuel metering and interconnect point at sit boundary as shown on drawings.
- 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.

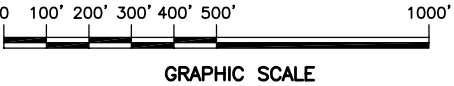
**Section 11.0 Drawings**

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

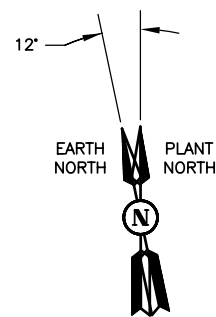
Overview General Arrangement Plot Plan	10-001 Sh 1
General Arrangement	10-002 Sh 1
Process Flow Diagram	50-001 Sh 1
Process Flow Diagram	50-001 Sh 2
Process Flow Diagram	50-001 Sh 3
One Line Diagram	60-001 Sh 1
One Line Diagram	60-001 Sh 2
One Line Diagram	60-002 Sh 1
One Line Diagram	60-002 Sh 2
One Line Diagram	60-002 Sh 3
One Line Diagram	60-002 Sh 4
One Line Diagram	60-002 Sh 5



NEW THREE (3) FRAME 7FA  
GAS TURBINE GENERATOR POWER PLANT  
(SEE DWG. NO. 10-002 SH 1 FOR PLOT PLAN DETAILS)



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										CHECK					OVERVIEW GENERAL ARRANGEMENT PLOT PLAN				
										DESIGN					THREE (3) FRAME 7FA SIMPLE CYCLE UNITS				
										PROJ ENGR					CARSON BAY ENERGY HOLDING				
										PROJ MGR									
										QA MGR									
										SCALE	1"=200'	SIZE			D				
					NO.	DATE	BY	APP'D	DESCRIPTION				JOB. NO.				DWG. NO.	SH. NO.	REV
									REVISIONS				T9030				10-001	1	A

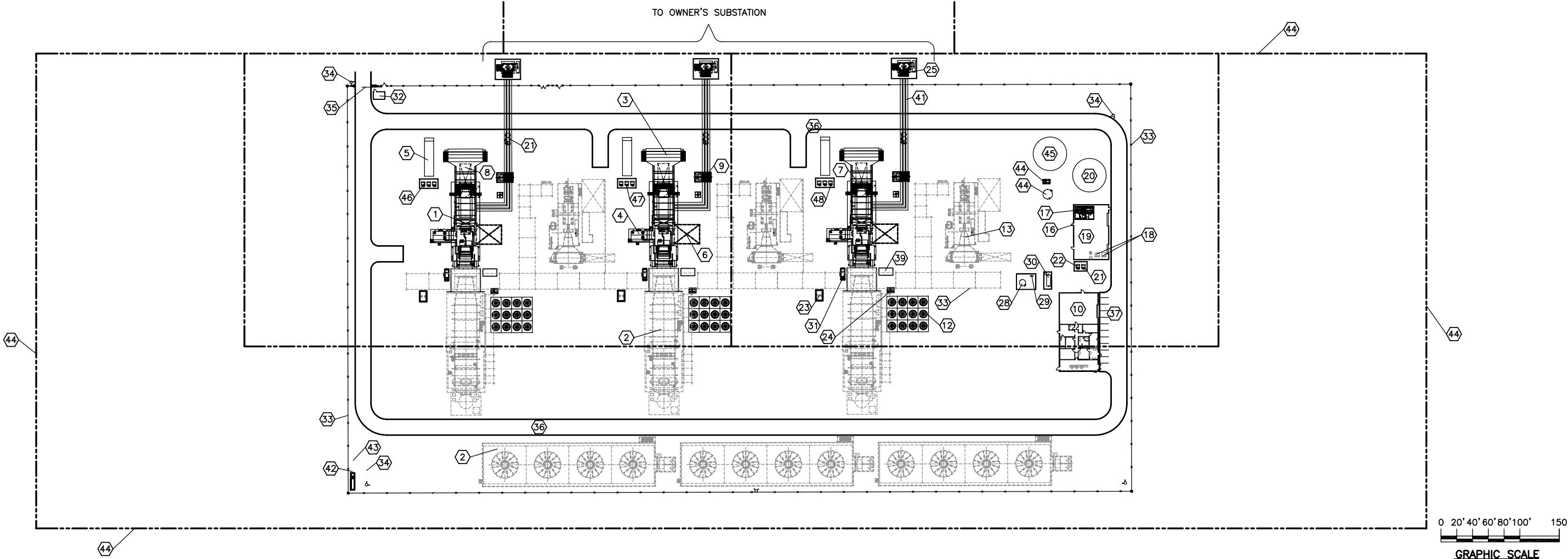


**LEGEND:**

- ① G.E. FRAME 7FA GAS TURBINE GENERATOR.
- ② HRSG (FUTURE).
- ③ AIR INLET.
- ④ ACCESSORY MODULE.
- ⑤ PEECC.
- ⑥ TURBINE REMOVAL AREA.
- ⑦ COOLER REMOVAL AREA.
- ⑧ GENERATOR REMOVAL AREA.
- ⑨ 18 KV BREAKER.
- ⑩ OFFICES/CONTROL/MAINTENANCE BUILDING.
- ⑪ EXHAUST STACK/DIVERTER VALVE.
- ⑫ LUBE OIL FIN FANS.

- ⑬ STEAM TURBINE GENERATOR AND BUILDING (FUTURE).
- ⑭ PIPE RACK (FUTURE).
- ⑮ STEAM TURBINE GENERATOR COOLING TOWER (FUTURE).
- ⑯ WATER TREATMENT BUILDING.
- ⑰ FIRE WATER SKID.
- ⑱ INSTRUMENT AIR DRYER PACKAGE.
- ⑲ WATER TREATMENT EQUIPMENT AREA.
- ⑳ RAW/FIRE WATER TANK (300,000 GALS).
- ㉑ BOP AUXILIARY TRANSFORMER (480 V).
- ㉒ BOP AUXILIARY TRANSFORMER (4.16 KV).
- ㉓ FUEL GAS FILTER/REGULATOR.
- ㉔ LUBE OIL COOLING WATER PUMP.
- ㉕ GTG STEP-UP TRANSFORMER (BY OWNER).
- ㉖ DEMIN WATER FORWARDING PUMP.
- ㉗ DEMIN WATER TANK (2-21,000 GAL EACH).
- ㉘ OILY WASTE TANK (5,000 GALS).
- ㉙ OILY WATER OFF-LOAD PUMP.

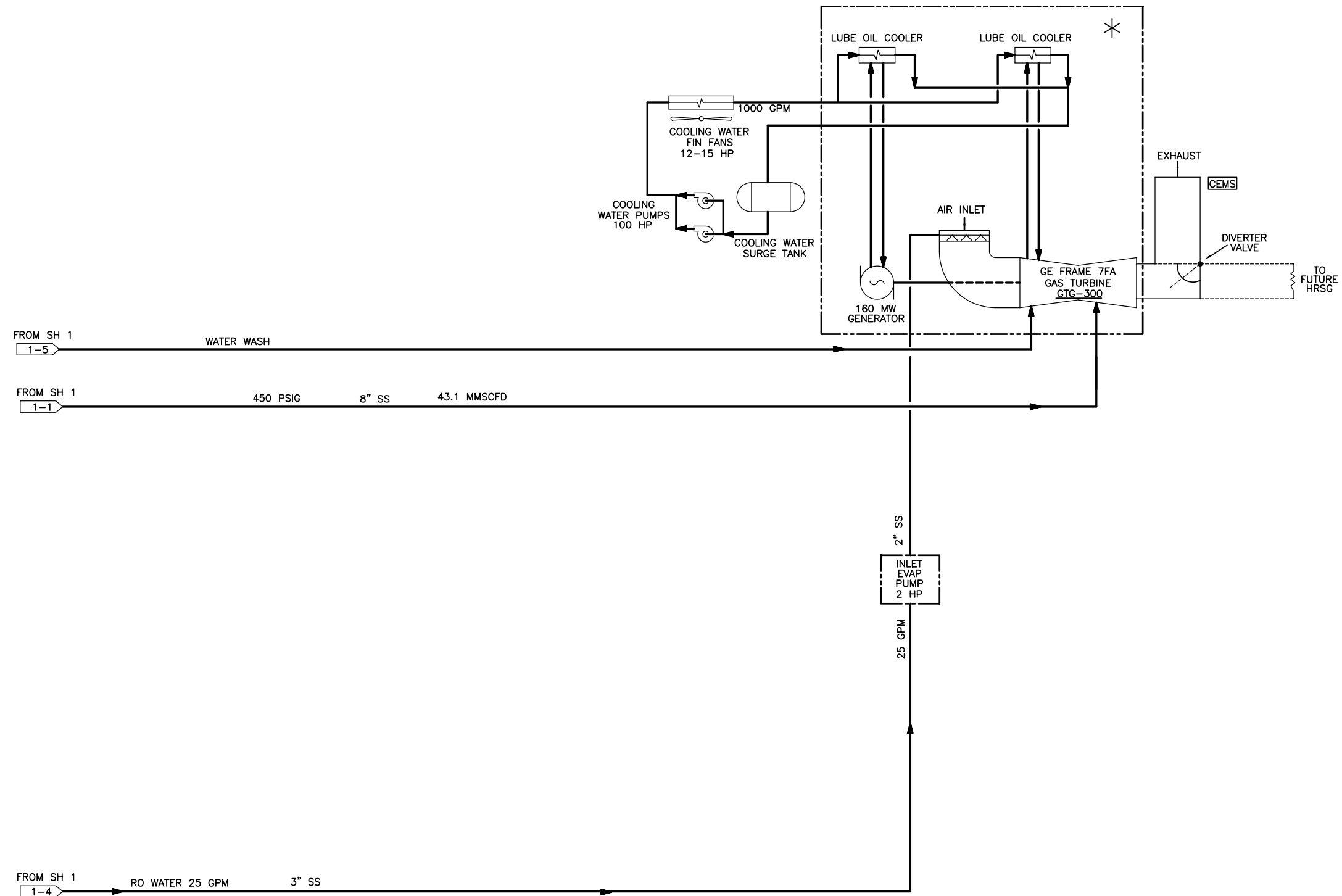
- ④① OILY WATER SEPARATOR.
- ④② CO2 TANK.
- ④③ GUARD HOUSE.
- ④④ PLANT FENCE.
- ④⑤ LIGHTING POLE.
- ④⑥ GATE.
- ④⑦ ROAD.
- ④⑧ PARKING AREA.
- ④⑨ STG STEP-UP TRANSFORMER (FUTURE).
- ④⑩ WATER WASH SKID.
- ④⑪ SUBSTATION AREA (BY OTHERS).
- ④⑫ ISO PHASE BUS.
- ④⑬ GAS METER RUN.
- ④⑭ ESD VALVE.
- ④⑮ PROPERTY BOUNDARY AREA.
- ④⑯ RO WATER TANK (200,000 GALS).
- ④⑰ UNIT AUXILIARY TRANSFORMER (480 V).
- ④⑱ UNIT STARTING TRANSFORMER.
- ④⑲ UNIT EXCITATION TRANSFORMER.



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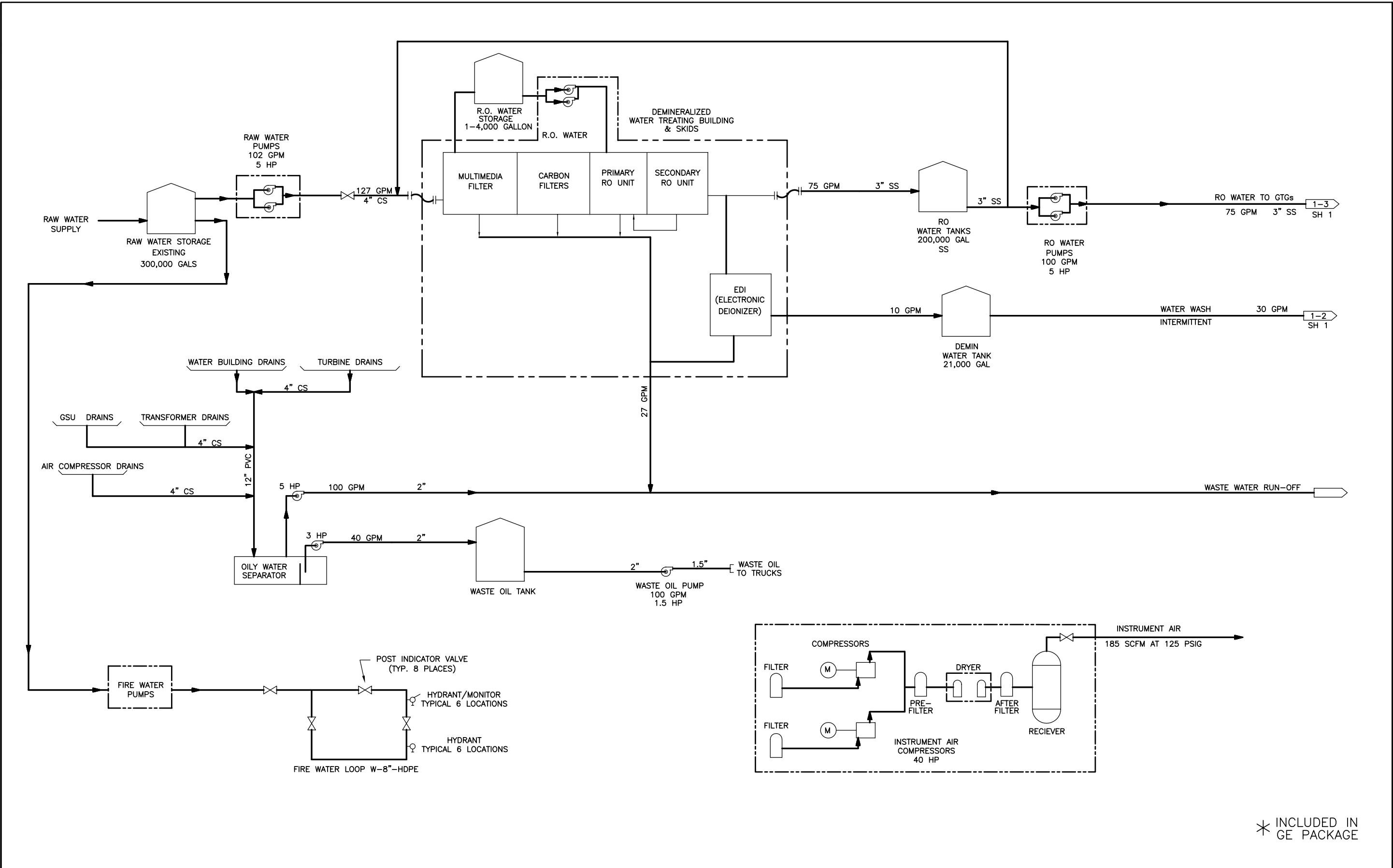






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DRAWN BP 06/23/09										<div></div> <div>907 S Detroit Ave SUITE 1140 TULSA, OKLAHOMA 74120 OFFICE FAX www.proenergyservices.com</div>										ProEnergy EPC Services, 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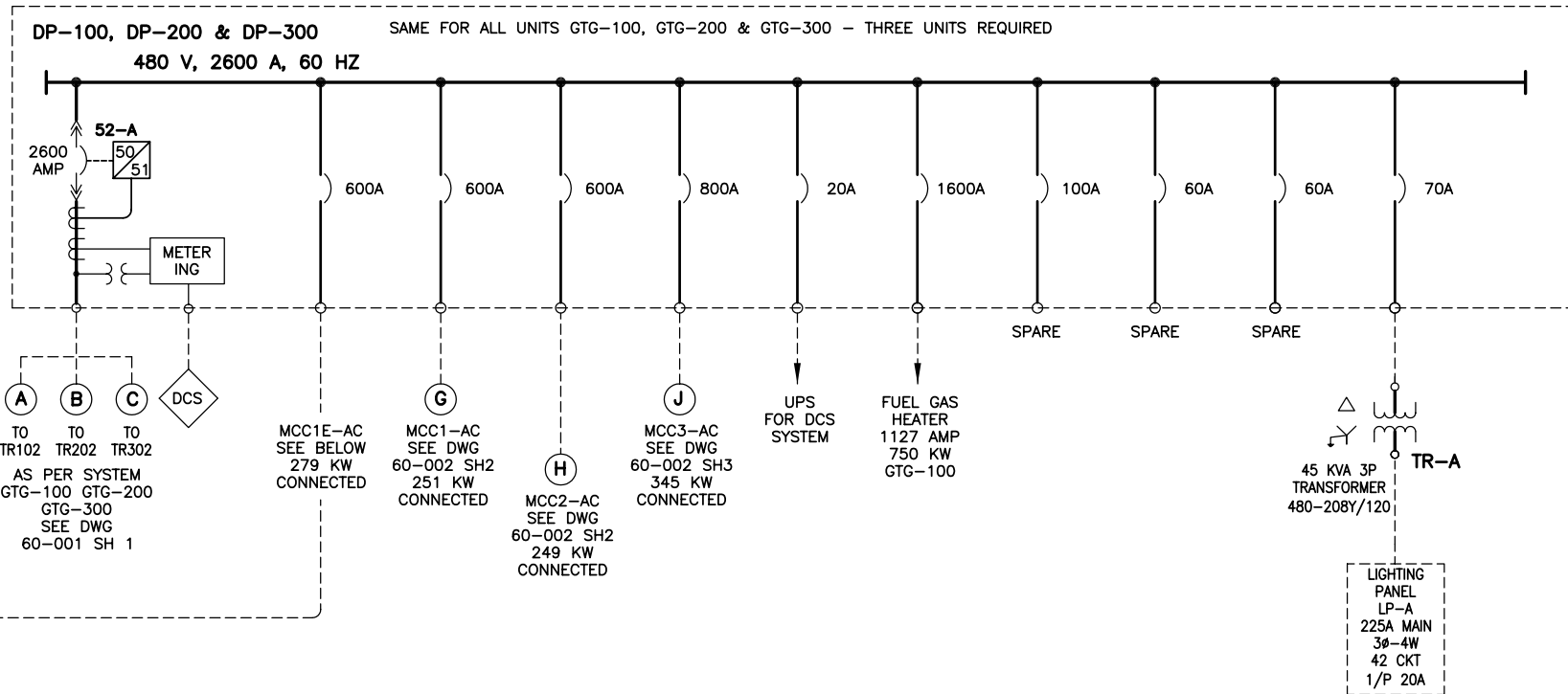


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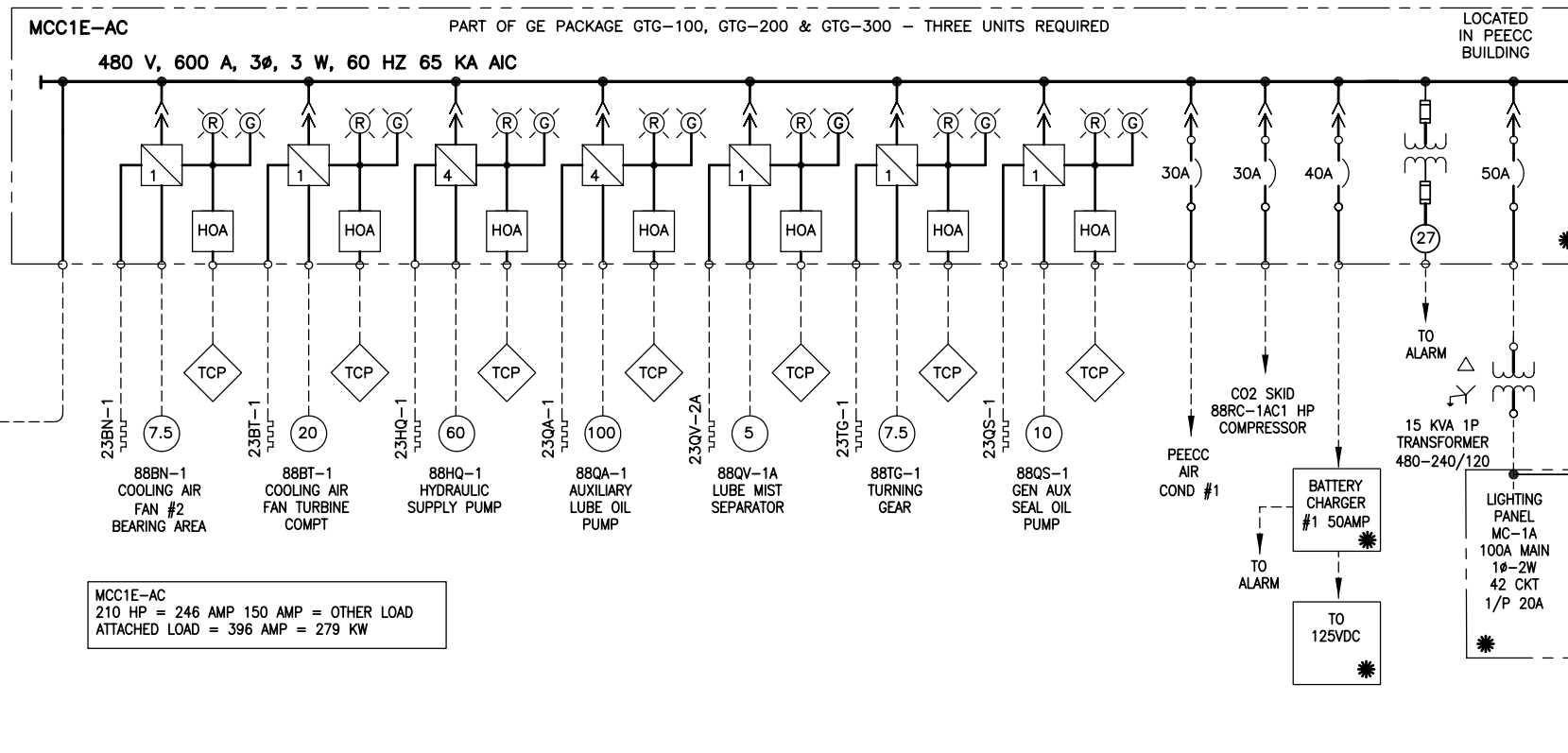
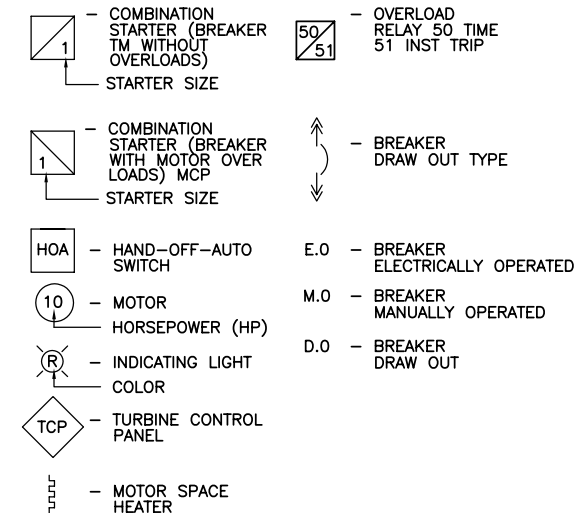






NOTE:  
88BD-1, 88BT-1-2 SHALL HAVE A CPT AT  
LEAST 300 VA

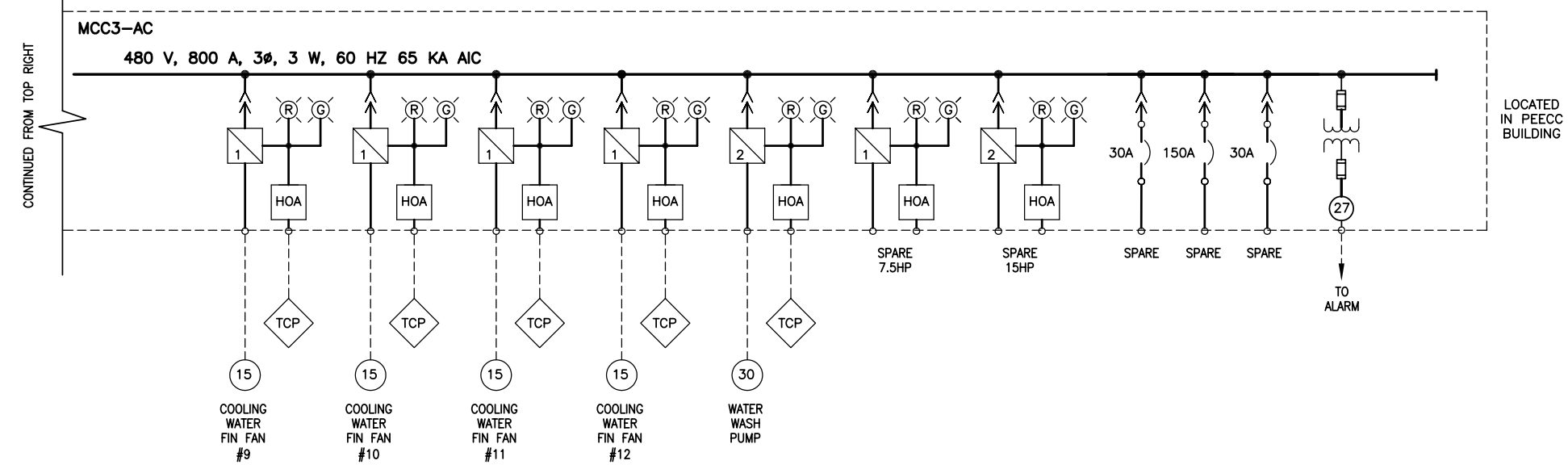
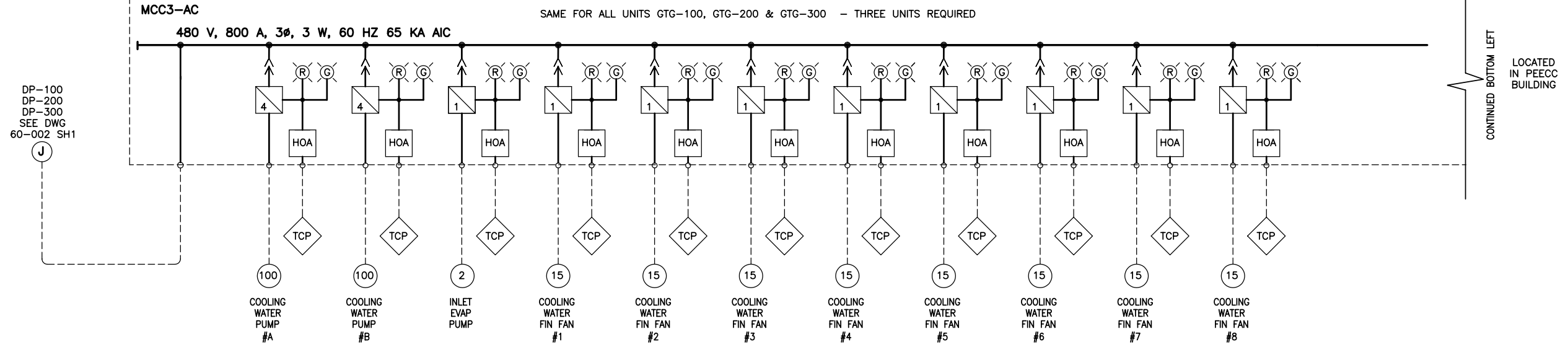
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












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MCC3-AC  
410 HP = 518A  
ATTACHED LOAD = 518A = 345 KW

- ### LEGEND:
- |   |  |   |   |
|---|--|---|---|
|  | - COMBINATION<br>STARTER (BREAKER<br>TM WITHOUT<br>OVERLOADS)      |  | - OVERLOAD<br>RELAY 50 TIME<br>51 INST TRIP |
|  | STARTER SIZE   |   |   |
|  | - COMBINATION<br>STARTER (BREAKER<br>WITH MOTOR OVER<br>LOADS) MCP |  | - BREAKER<br>DRAW OUT TYPE                  |
|  | STARTER SIZE   |   |   |
|  | - HAND-OFF-AUTO<br>SWITCH  |  | - BREAKER<br>ELECTRICALLY OPERATED          |
|  | - MOTOR<br>HORSEPOWER (HP)   |  | - BREAKER<br>MANUALLY OPERATED              |
|  |  |  | - BREAKER<br>DRAW OUT                       |
|  | - INDICATING LIGHT<br>COLOR  |   |   |
|  |  |   |   |
|  | - TURBINE CONTROL<br>PANEL   |   |   |
|  | - MOTOR SPACE<br>HEATER  |   |   |

  
INCLUDED IN GE PACKAGE

[illegible]







**Section 12.0 Appendix**

- 12.1 Site Location Map**
- 12.2 Raw Water Analysis (By Owner)**
- 12.3 Parasitic Loads (Later)**
- 12.4 Fuel Gas Analysis (By Owner)**
- 12.5 Demin Water Specifications (Later)**
- 12.6 Soils Report (BY Owner)**
- 12.7 Major Equipment Specifications**
  - 12.7.1 GE Frame 7FA Gas Turbine Generator**
  - 12.7.2 Diverter Valve / Exhaust Stack**
  - 12.7.3 Generator Step Up Transformer Specification**
  - 12.7.4 Oily Water Separator**
  - 12.7.5 Instrument Air Compressor**
  - 12.7.6 Plant DCS System (Later By ProEnergy EPC)**

## Section 12.1 Site Location Map





**Section 12.7.1 GE Frame 7FA Gas Turbine Generator (See Next Pages)**

## **Gas Turbine: 7FA/60Hz/171MW**

### **Unit 1**

General Electric PG7241FA

Dry Low NOx

## **Gas Turbine-298202** (Location: Newport News, Virginia)

Natural Gas

Starting: Static Start

Air Filtration: Two Stage Static

Exhaust System Axial Exhaust

Emission Control Gas-Dry Low Nox

Outdoor Enclosure Turbine and Accessory Compartments

Off-Base Acoustic Enclosure Turbine and Accessory Compartments

Off-Base Acoustic Enclosure Turbine Compartment

## **Generator-337X245** (Location: Newport News, Virginia)

Model 7FH2

Cooling Hydrogen

Frequency 60 Hz

Power Factor (PF) 0.85 Lagging

Terminal /Voltage 18.0 KV

Generator Excitation EX2000P-Static Bus Fed

Outdoor Enclosure Load Compartment

On-Base Lagging Accessory Base

## **Control Systems**

Turbine-Generator SPEEDTRONIC mark VI

- All auxiliary equipment for Unit 1 is stored in Harrison, New Jersey

## **Gas Turbine: 7FA/60Hz/171MW**

Unit 2

General Electric PG7241FA

Dry Low NOx

### **Gas Turbine-298389** (Location: Newport News, Virginia)

Natural Gas

Starting: Static Start

Air Filtration: Two Stage Static

Exhaust System Axial Exhaust

Emission Control Gas-Dry Low Nox

Outdoor Enclosure Turbine and Accessory Compartments

Off-Base Acoustic Enclosure Turbine and Accessory Compartments

Off-Base Acoustic Enclosure Turbine Compartment

### **Generator-338X530** (Location :Newport News, Virginia)

Model 7FH2

Cooling Hydrogen

Frequency 60 Hz

Power Factor (PF) 0.85 Lagging

Terminal /Voltage 18.0 KV

Generator Excitation EX2000P-Static Bus Fed

Outdoor Enclosure Load Compartment

On-Base Lagging Accessory Base

### **Control Systems**

Turbine-Generator SPEEDTRONIC mark VI

- All auxiliary equipment for Unit 2 is stored in Houston, Texas

## **Gas Turbine: 7FA/60Hz/171MW**

Unit 3

General Electric PG7241FA

Dry Low NOx

### **Gas Turbine-298319** (Location: Newport News, Virginia)

Natural Gas

Starting: Static Start

Air Filtration: Two Stage Static

Exhaust System Axial Exhaust

Emission Control Gas-Dry Low Nox

Outdoor Enclosure Turbine and Accessory Compartments

Off-Base Acoustic Enclosure Turbine and Accessory Compartments

Off-Base Acoustic Enclosure Turbine Compartment

### **Generator-338X757** (Location: Houston, Texas)

Model 7FH2

Cooling Hydrogen

Frequency 60 Hz

Power Factor (PF) 0.85 Lagging

Terminal /Voltage 18.0 KV

Generator Excitation EX2000P-Static Bus Fed

Outdoor Enclosure Load Compartment

On-Base Lagging Accessory Base

## **Control Systems**

Turbine-Generator SPEEDTRONIC mark VI

- All auxiliary equipment for Unit 3 is stored in Houston, Texas

**The information supplied below is generic for all three units and is intended as information only**

## **5.1 Gas Turbine Systems**

### **5.1.1 Gas Turbine**

Base-mounted PG7241 (FA) 60 Hz gas turbine including:

- Modulating IGV

### **5.1.2 Combustion System**

- Dry Low NOx combustion system
- Combustion system features
  - Thermal barrier coated liners
  - Nimonic transition pieces
  - Reuter Stokes SiC flame detectors
  - With compressor inlet heating

### **5.1.3 Fuel Systems**

#### **5.1.3.1 Gas Fuel System**

- Natural gas only
- Stainless steel gas piping
- Orifice type gas flow measurement system
- Single gas strainer
- Gas fuel temperature supplied per GEI-41040F- Heater by Owner
- Gas fuel valves on accessory base
- Gas fuel cleaning equipment
  - Fuel gas scrubber, Duplex

### **5.1.4 Lubricating and Hydraulic Systems**

#### **5.1.4.1 Pumps**

- AC motor driven dual lube oil pumps
- AC motor driven dual hydraulic pumps
  - Used for jacking oil also
- DC motor driven, emergency lube oil pump
- AC/DC motor driven auxiliary generator seal oil pump

#### **5.1.4.2 Filters and Coolers**

- Dual lube oil system filters
- Dual hydraulic oil filters
- Dual lube oil coolers
  - With 90-10 copper-nickel straight-tubes
- ASME code stamp



- . Lube oil coolers
- . Lube oil filters

#### **5.1.4.3 Lube Oil Piping**

- 304L stainless steel lube oil feed pipe
- Carbon steel lube oil drain pipe
- Lube system valve stainless steel trim

#### **5.1.4.4 Mist Elimination**

- Lube vent demister

#### **5.1.4.5 Oil Reservoir**

- With heater for -20°F

#### **5.1.4.6 Instrumentation**

- Delta pressure switches for lubrication and hydraulic oil filters
- Lubrication oil header pressure transmitter
- Lubrication oil tank level transmitter
- Lubrication oil filter differential pressure transmitter
- Hydraulic oil supply pressure transmitter

### **5.1.5 Inlet System**

- Inlet system arrangement
  - . Up and forward inlet system arrangement
  - . Inlet compartment supports straddle ductline
- Inlet filtration
  - . Two-stage static filter; prefilter and high efficiency filter
  - . Filter media (high humidity)
  - . 50 micron moisture separator
  - . Weather protection on inlet filter compartment
  - . Inlet system differential pressure indicator
  - . Inlet system differential pressure alarm
  - . Inlet filter compartment support steel
  - . Caged ladder access to inlet filter compartment
  - . Left hand access to inlet filter compartment
  - . Inlet filter compartment interior lighting
- Inlet heating
  - . Bleed heat manifold located in duct
  - . DLN premix turndown inlet bleed heat control
  - . Compressor pressure ratio operating limit bleed heat control
  - . Inlet bleed heat control valve(s)
- Inlet ducting
  - . Inlet silencing
  - . Inlet expansion joint

- . Inlet 90 degree elbow
- . Inlet transition piece
- . Inlet ducting support steel
- . Diluent injection instrumentation
- . Compressor inlet humidity sensor
- . Compressor inlet temperature thermocouple
- Inlet system atmospheric protection
  - . Zinc rich paint inside and outside of inlet filter compartment
  - . Epoxy overcoat inside and outside inlet filter compartment
  - . Galvanized inlet filter compartment support steel
  - . Zinc rich paint inside and outside of inlet ducting with epoxy top coat
  - . Epoxy top coat outside of inlet ducting
  - . Stainless steel inlet silencing perforated sheet
  - . Galvanized inlet ducting support steel

## **5.1.6 Exhaust System**

### **5.1.6.1 Arrangement**

- Exhaust diffuser with an axial exit
- Exhaust expansion joint

## **5.1.7 Couplings**

- Rigid load coupling
- Load coupling guard

## **5.1.8 Gas Turbine Packaging**

- Lagging and enclosures
  - . On-base accessory compartment lagging
  - . Off-base acoustic enclosure for turbine only
  - . Off-base load coupling compartment enclosure
  - . Acoustic barrier wall around exhaust diffuser
- Compartment ventilation, pressurization and heating
  - . Dual turbine compartment vent fans
  - . Dual accessory compartment vent fans
  - . Dual load compartment vent fans
  - . Heated turbine and accessory compartments for humidity control
- Plant arrangement
  - . Turbine designed for installation outdoors
  - . Right hand accessory module
  - . Exterior unit walkways by customer, mounting pads by GE
  - . Interior unit walkways
- Turbine and accessory base painting
  - . Standard primer only
- UBC Seismic Zone 4 (except for inlet and exhaust)

- UBC Seismic Zone 2A for inlet and exhaust
- Hazardous area classification
  - . NEC Class1, Group D, Division 2
  - . Turbine compartment
  - . Natural gas fuel compartment
- Special features
  - . Dual (metric-English) indicators and gauges

### **5.1.9 Fire Protection System**

- Fire detection system
  - . Turbine and accessory compartments
- Smoke detection system
  - . Control cab/PEECC
- Compartment warning signs
- CO2 supply system
  - . One low pressure CO2 tank per unit
  - . Tank suitable for 0-120°F (-18 to 49°C)
- Fire protection piping
  - . Turbine and accessory enclosures
- Hazardous atmosphere detectors in turbine and gas fuel compartments
  - . CHx detectors - natural gas compartment
  - . CHx detectors - turbine gas compartment
- Hazardous atmosphere detector readout
  - . CHx

### **5.1.10 Cleaning Systems**

- On base piping for on and offline compressor water wash system
- Water wash skid
  - . Water storage tank
  - . Skid enclosure
  - . Single skid per site (1 skid per 3 units)

### **5.1.11 Cooling Water System**

- Cooling system temperature regulating valve

### **5.1.12 Starting Systems**

- Static start
  - . Generator start with inverter/regulator
  - . Static start isolation transformer
  - . Oil filled
- Rotor turning systems
  - . Turning gear and motor for rotor cooldown
  - . Rotor indexing (borescope inspection)

### **5.1.13 Miscellaneous Systems**

#### **5.1.13.1 Special Systems**

- Exhaust frame blowers on turbine compartment roof

## **5.2 Generator**

### **5.2.1 General Information**

- Hydrogen cooled generator with conventionally cooled armature
- Outdoor installation
- 60 Hz generator frequency
- Generator voltage 18.0 kV
- 0.85 power factor (lagging)
- Capability to 1.00 power factor (leading)
- Class .F. armature and rotor insulation
- Class .B. temperature rise, armature and rotor winding
- Generator bearings
  - . End shield bearing support
  - . Elliptical journal bearings
  - . Roll out bearing capability without removing rotor
  - . Insulated collector end bearing
  - . Online bearing insulation check
  - . Offline bearing insulation check with isolated rotor
- Monitoring Devices
  - . Two (2) velocity vibration probes at turbine end, one (1) at collector end
  - . Provisions for key phasor-generator
  - . Provisions for permanent flux probe
  - . Proximity vibration probes
  - . Two probes per bearing at 45° angle
- Generator Field
  - . Direct cooled field
  - . Two-pole field
  - . Finger type amortisseurs

### **5.2.2 Generator Gas Coolers**

- Coolers shipped installed
- Generator gas cooler configuration
  - . Five (5) horizontally mounted simplex coolers
  - . Coolers located in generator base
  - . Cooler piping connections on left side as viewed from collector end
  - . ASME code stamp
  - . Single wall cooler tubes
  - . Victaulic cooler couplings
  - . Plate fins

- . Cooling water manifold and isolation valves
- Generator gas cooling system characteristics
  - . Coolant temperature
  - . Not defined
  - . Generator capacity with one section out of service 80% with Class “F” rise
  - . TEMA class C coolers
  - . Maximum cooler pressure capability - 125 psi
  - . Fouling factor 0.0005
- Generator gas cooler construction materials
  - . 90-10 copper-nickel tubes
  - . Carbon steel tube sheets
  - . Carbon steel waterbox and coupling flanges with epoxy coating
  - . Aluminum cooler tube fins

### **5.2.3 Generator Lube Oil Systems and Equipment**

- Bearing lube oil system
  - . Generator lube oil system integral with turbine
  - . Sight flow indicator
- Bearing lift oil system
  - . Stainless steel lift oil piping and tubing
  - . Lift oil supplied from turbine oil system
- Lube oil system piping materials
  - . Stainless steel lube oil feed pipe
  - . Carbon steel lube oil drain pipe
  - . Welded oil piping

### **5.2.4 Generator Grounding Equipment**

- Neutral grounding equipment
  - . Neutral ground transformer and secondary resistor
  - . Mounted in terminal enclosure
  - . Motor operated neutral disconnect switch

### **5.2.5 Generator Temperature Devices**

- Stator winding temperature devices
  - . 100 ohm platinum RTDs (resistance temperature detector)
  - . Single element RTDs
  - . Grounded RTDs
  - . Nine (9) stator slot RTDs
- Gas path temperature devices
  - . 100 ohm platinum gas path RTDs
  - . Single element temperature sensors
  - . Four (4) cold gas
  - . Two (2) hot gas
  - . GTG-2 (common cold gas)

- Bearing temperature devices
  - . Chromel alumel (type K) thermocouples
  - . Dual element temperature sensors
  - . Two (2) bearing metal temperature sensors per bearing
- Collector temperature devices
  - . 100 ohm platinum RTDs
  - . Single element temperature sensors
  - . Collector air inlet temperature sensor
  - . Collector air outlet temperature sensor
- Lube oil system temperature devices
  - . Chromel alumel (type K) thermocouples
  - . Dual element temperature sensors
  - . One (1) bearing drain temperature sensor per drain

## **5.2.6 Packaging, Enclosures, and Compartments**

- Paint and preservation
  - . Standard alkyd beige primer
- High voltage bushings
  - . High voltage bushings shipped installed
  - . Six (6) ambient air cooled, high voltage bushings
- Generator terminal enclosure (GTE)
- Line-side terminal enclosure
  - . Terminal enclosure shipped separate
  - . Isolated phase bus duct connection
  - . Phase sequence R-C-L when looking at enclosure terminals
  - . Outgoing power connection on right side when viewed from collector end
  - . Lightning arresters
- Neutral terminal enclosure
  - . Neutral terminals integral with line-side terminal enclosure
  - . Neutral tie
- Collector compartment/enclosure
  - . Collector compartment/enclosure shipped separate
  - . Outdoor
  - . Collector/brush holding rigging
- Compartment lighting and outlets
  - . AC lighting
  - . Collector compartment
- Foundation hardware
  - . Generator shims
  - . Generator alignment key(s) - collector end
  - . Generator alignment key(s) - turbine end
  - . Generator alignment key(s) - axial

## **5.2.7 Hydrogen Systems and Accessories**

- Hydrogen gas manifolds
  - . Auto purge gas purge control manifold
  - . Hydrogen/CO2 control valve assembly
  - . H2 Bottle manifold not provided
  - . CO2 bottle manifold not provided
- Seal oil system
  - . Control unit mounted in collector compartment
  - . Stainless steel seal oil feed pipe
  - . Carbon steel seal oil drain pipe

## **5.2.8 Electrical Equipment**

- Motors
  - . TEFC motors
  - . Coated with antifungal material for protection in tropical areas
  - . High ambient motor insulation
  - . Motor heaters connected to ac power
  - . Extra severe duty motors
  - . Cast iron motor housings
- Heaters
  - . Generator stator heaters
  - . Generator collector heaters

## **5.2.9 Generator Excitation Systems, Static Components**

- Bus fed static excitation with hot backup bridge

### **5.2.9.1 Excitation Module Features**

- Control/monitor/display through TCP
  - . Voltage matching in turbine control system
  - . Power factor controller in turbine control system
  - . Var controller in turbine control system
  - . Selection of automatic or manual regulator
  - . Raise-lower of the active regulator setpoint
  - . Enter setpoint command
  - . Display field amps
  - . Display field volts
  - . Display transfer volts
- Built-in diagnostic display panel
  - . Automatic voltage regulator (AVR)
  - . Manual voltage regulator (FVR)
  - . Automatic and manual bi-directional tracking
  - . Reactive current compensation (RCC)
  - . Volts per hertz limiter (V/Hz LIM)
  - . Volts per hertz protection (24EX) (Backup to 24G)
  - . Over excitation limiter (OEL)

- . Offline/online over excitation protection (76EX)
- . Loss of excitation protection (40EX)
- . Bridge ac phase unbalance protection (47EX)
- . Under excitation limiter (UEL)
- . Generator overvoltage protection (59EX)
- . Generator field ground detector trip (64FT)
- . VT failure detector (VTFD) (60EX)
- . Field over-temperature alarm
- . Field ground detector alarm (64FA)
- . Exciter phase voltage imbalance (47EX)
- . Bridge over-temperature (26EX)
- Dual source internal bulk power supply
- Millivolt shunt for field
- Surge protection
  - . VT disconnect and CT shorting switches
  - . Two phase current sensing
  - . Three phase voltage sensing
  - . Single pole dc field contactor/bridge
- Thyristor bridge circuit filtering
- Shaft voltage suppressor circuit (mounted in panel)
  - . Field de-excitation circuit (with field discharge inductor)
  - . Bridge disconnect; ac no load

#### **5.2.9.2 Performance**

- 2.0 response ratio and 160% VFFL (100°C) ceiling @  $V_t = 1.0\text{pu}$

#### **5.2.9.3 Excitation Enclosure Location**

- Installed in LCI/EX compartment

#### **5.2.9.4 LCI Features**

- LCI located in LCI/EX compartment
- LCI disconnect switch (89SS)
  - . Located in generator terminal enclosure
- LCI fuse
  - . Located in compartment with LCI

#### **5.2.9.5 PPT Features**

- Freestanding oil-filled PPT for outdoor installation
- PPT fed from auxiliary bus

### **5.2.10 Generator Current Transformers and Potential Transformers**

- Current transformers (CTs)
  - . C400 current transformers (CTs)
  - . Line side CTs



- . CT 19A, C (excitation)
- . CT 21, 22, 23 (generator differential relay)
- . Neutral CTs
- . CT1, CT2, CT3
- . CT4, CT5, CT6
- . CT7, CT8, CT9
- Potential transformers (PTs)
  - . Fixed
  - . VT2, generator line side

## **5.3 Gas Turbine-Generator Controls and Electric Auxiliaries**

### **5.3.1 Control Cab/Packaged Electric and Electronic Control Compartment (PEECC)**

- Weatherproof, climate controlled, base mounted enclosure
- Supplemental wall-mounted air conditioner

### **5.3.2 Gas Turbine Control System Panel Features**

- Triple modular redundant (TMR)
- Skid mounted control panel
- Auto/manual synchronizing module with synchronizing check function
- Generator stator overtemperature alarm (49)
- Droop control
- Load limiter
- Purge cycle
- Customer alarm/trip contact for CRT display
- Vibration alarm readout and trip
- Electrical overspeed protection
- Constant settable droop
- Power factor calculation and display
- Power factor control
- VAR control
- Manual set point preselected load
- IRIG-B interface (time signal by others)

### **5.3.3 Local Operator Station**

- Commercial grade personal computer
- Color monitor
  - . Table top
  - . 17 in. screen
- Mouse cursor control
- Table top AT 101 keyboard

- Printer
  - . 24 pin dot matrix
- Display in English language
- RS232C two way serial link (MODBUS) via local HMI

#### **5.3.4 Remote Control and Monitoring Systems**

- RS232C two way serial link (MODBUS) via remote HMI
- Multi-unit remote HMI
  - . One per site
- Commercial grade personal computer
- Color monitor
  - . Table top
  - . 20 in. screen
- Mouse cursor control
- Table top AT 101 keyboard
- Printer
  - . Printer, color ink jet
- Power 120Vac 60 Hz

#### **5.3.5 Rotor, Bearing and Performance Monitoring Systems**

- Performance monitoring systems
  - . Performance monitoring sensors wired to gas turbine control system
  - . Performance calculations in <I>/HMI
- Vibration sensors
  - . Velocity vibration sensors
  - . Proximity vibration sensors
- Bently Nevada 3500 monitor
  - . With local display panel
  - . Relay outputs wired to gas turbine control panel
  - . Mounted with generator control panel
- Bearing thermocouples
  - . Bearing drain thermocouples
  - . Bearing metal thermocouples
- Borescope access holes

#### **5.3.6 Generator Control Panel**

##### **5.3.6.1 Generator Control Panel Hardware**

- Mounted in PEECC
- Skid mounted with turbine panel
- DGP with test plug capability
- DGP without ModBus communication interface
- DGP with communication interface

- DGP with IRIG-B interface
- DGP with oscillography capture
- DGP with redundant internal power supply
- Generator breaker trip switch (52G/CS)
- Humidity sensor readout
- Hazardous atmosphere detector readout
- Bentley Nevada vibration monitor(s)

#### **5.3.6.2 Digital Generator Protection System (DGP)**

- Generator overexcitation (24)
- Generator undervoltage (27G)
- Reverse power/anti-motoring (32-1)
- Reverse power/anti-motoring (32-2)
- Loss of excitation (40-1,2)
- Current unbalance/negative phase sequence (46)
- System phase fault (51V)
- Generator overvoltage (59)
- Stator ground detection (64G1)/(59GN)
- Generator over/under frequency (81O-1, 81U-1)
- Generator differential (87G)
- Voltage transformer fuse failure (VTFF)

#### **5.3.6.3 Generator Protection Discrete Relays**

- Synchronizing undervoltage relay (27BS-1,2)
- Reverse/inadvertent energization protection relay (50RE/86RE)
- Generator differential lockout relay (86G-1)
- Second generator lockout relay (86G-2)

#### **5.3.6.4 Features Integrated Into Gas Turbine Control System**

- Gas turbine control system with speed matching, synchronization and check
- Manual synchronization displayed on gas turbine control system <I> / HMI
- Auto/manual synchronizing module displayed on gas turbine control system <I> / HMI
- Load control in gas turbine control system
- Temperature indication for generator RTDs
- Generator voltage matching (90VM)

#### **5.3.6.5 Generator Control Panel Metering**

- Generator digital multimeter  
. VM - Generator volts

- . AM - Generator Amps: Phase 1,2,3 and Neutral
- . MW - Generator MegaWatts
- . MVAR - Generator MegaVARs
- . FM - Generator frequency
- . MVA - Generator MVA
- . PF - Generator power factor

#### **5.3.6.6 Generator Control Panel Transducers**

- Generator watt/VAR transducer 4-20 mA output for input to TCP (96GG-1)
- Generator TCP/droop control transducer 4-20 mA output (96GW-1)
- Generator watt/VAR transducer 4-20mA output for customer (96GG-2)

#### **5.3.7 Generator Protection**

- Generator electrical protection equipment
- . Ground brush rigging

#### **5.3.8 Batteries and Accessories**

- Lead acid battery
- Single phase battery charger
- Second battery charger
- Battery and charger mounted in the PEECC

#### **5.3.9 Motor Control Center**

- MCC mounted in control cab/PEECC
- Tin-plated copper bus-work
- 65 kA bracing
- 480V 60 Hz auxiliary power

#### **5.3.10 Motor Features**

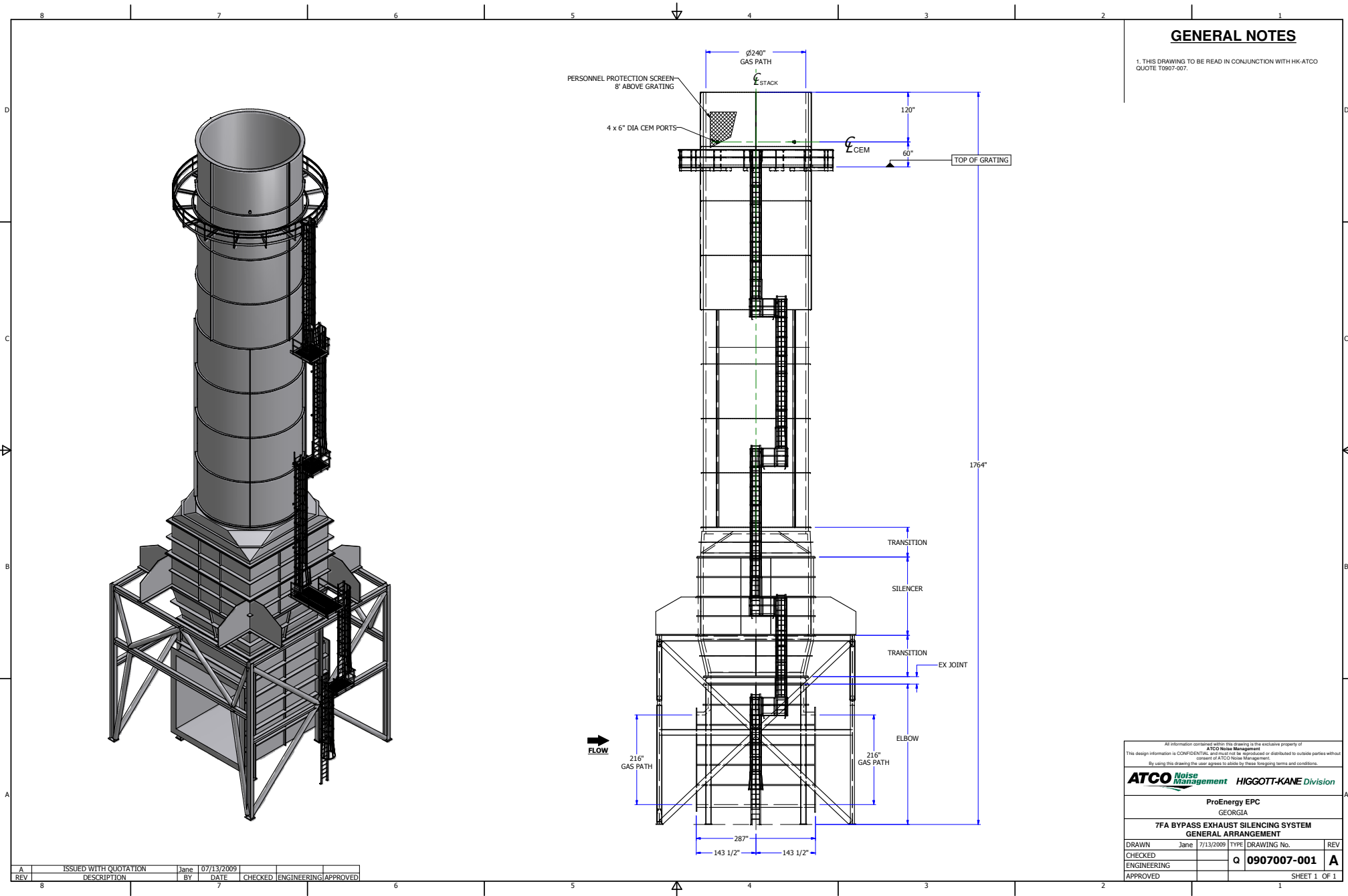
- TEFC motors less than or equal to 200 hp
- Coated with antifungal material for protection in tropical areas
- High ambient motor insulation
- Energy saver motors
- Extra severe duty motors
- Cast iron motor housings
- All redundant motors to be lead/lag
- Motor heaters
- . Rated 110/120 volts, 50/60 Hz
- WP motors >200 hp

## 5.4 Services

- Technical advisory services: \$1,750,000US credit available towards GE services.
- Documentation
  - 1 set of English language service manuals per Unit, including Operation, Maintenance and Parts volumes
- Turbine maintenance tools (1 set per site)
  - . Guide pins (for removal or replacement of bearing caps, compressor casing and exhaust frame)
  - . Fuel nozzle wrenches
  - . Fuel nozzle test fixture
  - . Spark plug electrode tool
  - . Clearance tools
  - . Fuel nozzle staking tool
  - . Combustion liner tool
  - . Bearing and coupling disassembly fixture
- Generator maintenance tools (1 set per site)
  - . Rotor lifting slings
  - . Rotor removal equipment including shoes, pans, pulling devices
  - . Rotor jacking bolts
- Installation equipment
  - . Trunions for generator
  - . On permanent basis
  - . Jacking bolts for generator
  - . Foundation/installation washer and shim packs



**Section 12.7.2 Diverter Valve / Exhaust Stack (See Next Page)**





**Section 12.7.3      Generator Step Up Transformer Specification (See Next Page)**



**Generator Step Up Transformer (GSU)**  
**Manufacture plant:**

DATE

**POWER TRANSFORMER PERFORMANCE SPECIFICATION**

**FOR**

ProEnergy EPC Services

**ITEM No.**

<b>Type</b>	<b>Cooling</b>	<b>H Winding</b>		<b>X Winding</b>		<b>Y Winding</b>	
Core form	Core Type	kV	500	kV	18	kV	0
3 Phase	ONAN	MVA	120	MVA	120	MVA	
60 Hertz	ONAF	MVA	160	MVA	160	MVA	
55 °C. Temp Rise	ONAF	MVA	200	MVA	210	MVA	

**ADDITIONAL APPROXIMATE VOLTAGES**

H Winding	+/- 2 @2.5% DETC FC
X Winding	(none)
Y Winding	(none)

**CONNECTIONS FOR OPERATION**

<b>Transf. in Bank</b>	<b>To Transform From</b>	<b>Connected</b>	<b>To Transform to</b>	<b>Connected</b>
1	18 KV. 3 Phase	delta	500 KV. 3 Phase	grd. wye

**DIELECTRIC TESTS**

<b><u>Applied Voltage (to other windings &amp; ground)</u></b>	
H Winding (kV)	Per ANSI
X Winding (kV)	
Y Winding (kV)	

<b><u>Induced Voltage (phase-ground)</u></b>	
One-hour level (kV)	Per ANSI
Enhancement level (kV)	

<b><u>BASIC IMPULSE LEVEL</u></b>			<b><u>IMPEDANCE VOLTS (Percent)</u></b>		<b><u>PERFORMANCE DATA LOADING</u></b>	
H Line kV	1470		H to X % 10 (500 to 18 KV) at xx MVA		H Winding kV	132 MVA
H Neutral kV	110				X Winding kV	11.5 MVA
X Line kV	150				Y Winding kV	MVA
X Neutral kV						
Y Line kV						

<b><u>SOUND LEVEL</u></b> dB(A)	Per NEMA
---------------------------------	----------

<b><u>AUXILIARY LOSS</u></b> (kW)	
-----------------------------------	--

**PERFORMANCE DATA**

<b><u>Excitation</u></b>	<b><u>Exciting Current</u></b>	<b><u>No-Load Loss</u></b>	<b><u>Total Loss</u></b>	<b><u>Percent Regulation</u></b>
100% V	(%)	(kW)	(kW)	100% PF 80% PF
110% V	(%)	(kW)		
Exciting current at base MVA				

**APPROXIMATE DIMENSIONS (inches). WEIGHTS (pounds): Not for construction purposes**

Outline Drawing No. SAT			
Height Overall			Shipping
Length / Depth			
Width			
Height over Case			
Untanking Height			

Core and Coils		
Case and Fittings		
Oil ( 5416 Gals.)		
Total Weight		
Shipping (heaviest piece)		
Shipped in dry air or nitrogen		

**Remarks: Liquid preservation System with Inert Gas Pressure System.**



**Section 12.7.4      Oily Water Separator (See Next Pages)**

# Cylindrical Oil/Water Separators

*Available with a UL-SU2215 Construction & Performance Label*



**Highland Tank®**



## Cylindrical Design

Highland Oil/Water Separators are used specifically for the removal of free floating oil, grease, and settleable oily coated solids from oil/water discharges associated with many types of petroleum, industrial, commercial, military, and municipal facilities.

Highland's separators help these facilities comply with the EPA's regulations for the proper treatment and discharge of contaminated storm water runoff. They also help these facilities satisfy their SPCC requirements for spill control and secondary containment.

Designed to remove oils with a specific gravity less than .95, high performance separators from 15 ppm oil/grease discharge (Model HT) down to 10 ppm discharge (Model HTC) are available.

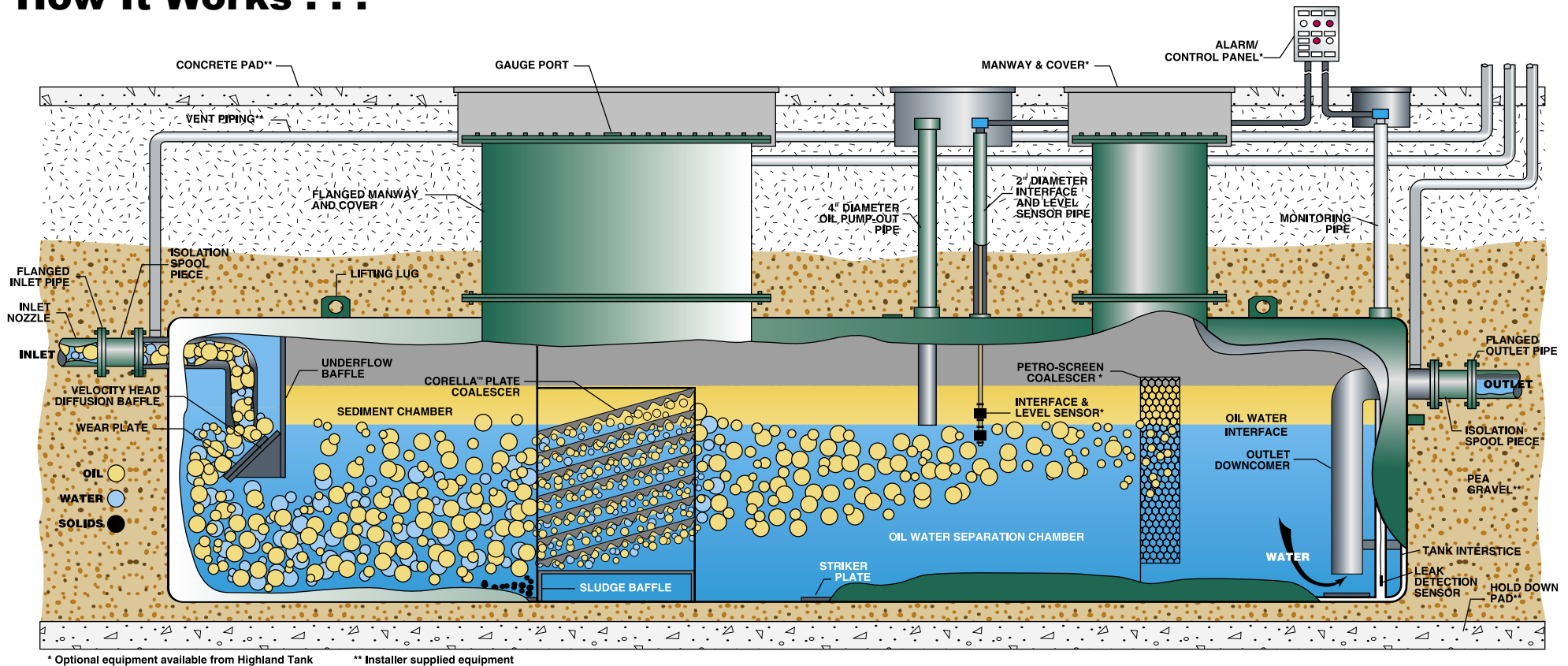
All Highland separators are equipped with Corella® inclined parallel plate coalescers that combines the features of both a flat plate coalescer and a corrugated plate coalescer into a new "self-cleaning" design that performs better than traditional plate separators.

Utilizing Highland's EZ Access manways, inspection of the Corella® is easy, without a dangerous confined space entry.

Highland separators are of the highest quality — constructed to American Petroleum Institute (API) and Underwriters Laboratories Inc. (UL) specifications.

Highland oil/water separators come in a variety of designs and are available in single-walled or double-walled construction for aboveground or underground installation.

# How It Works . . .



## Highland's Patented Design

Highland patented oil/water separators are stationary wastewater treatment vessels, filled with water. They contain specially designed internal baffles and coalescers to accelerate the separation process. The vessel is designed for unconfined access from above for inspection and maintenance.

Inlet flow is directed against the velocity head diffusion baffle to reduce flow turbulence and to distribute the flow evenly over the separator's cross

sectional area. In the sediment chamber, heavy solids settle out and concentrated oil rises to the surface. The oily water then passes through the Corella® Coalescer, an inclined arrangement of stacked parallel flat and corrugated plates.

The corrugated underside of the Corella® plates causes the oil to coalesce into sheets. The oil globules then rise to the surface of the separation chamber, where the separated oil accumulates.

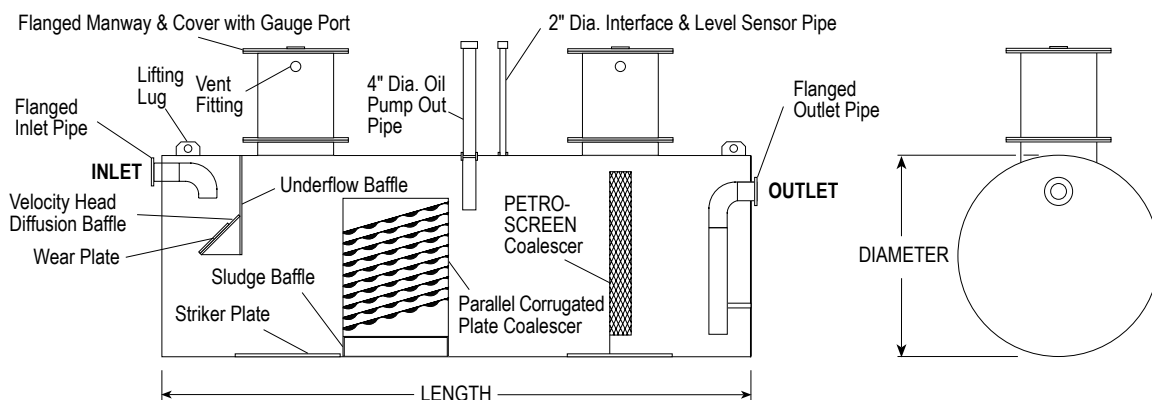
Any remaining solids sink to the top of the plates and slide off of the plates to the solids collection area. The effluent flows downward to the outlet and is discharged by gravity displacement.

To intercept droplets of oil too minute to be removed by the parallel flat/corrugated plates, we use a Petro-Screen polypropylene impingement coalescer (an encased bundle of layered oil-attracting fibers). Large EZ-Access

chambers allow for total, unconfined, unrestricted access from above to the removable Corella® and Petro-Screen coalescers for safe visual inspection, cleaning, and maintenance.

Electronic oil level controls sound an alarm at high oil levels so that waste oil can be removed from the separator. Double-walled separators are monitored with electronic leak detection systems for the interstitial space.

**General Arrangement**  
Model HTC HighGuard,  
Single-walled  
Oil/Water Separator with  
Gravity Discharge shown

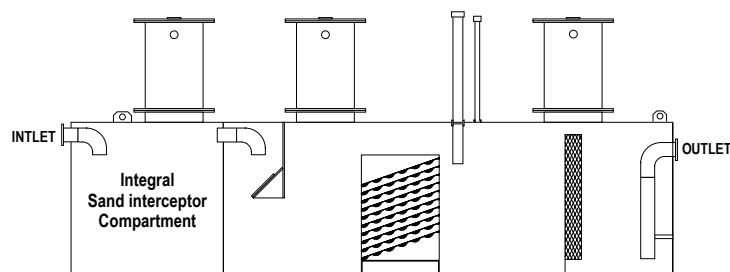


**Design Options**

Separator installations vary greatly with each location. Highland custom fabricates oil/water separators to satisfy your specific needs. The following information illustrates some of the influent and effluent/product handling options available.

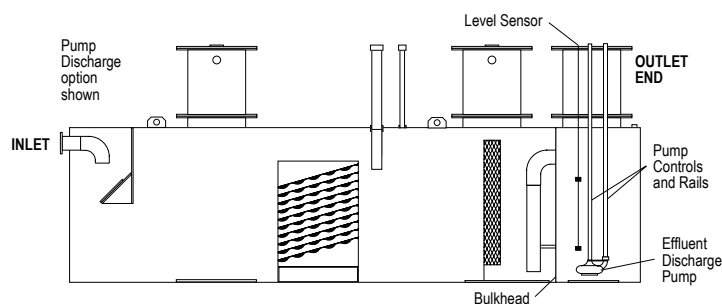
**Series G**

Series G oil/water separators feature an integral sand interceptor compartment to permit sand and gravel to settle out before the wastewater enters the oil/water separator.



**Series J**

Series J oil/water separators have an integral effluent pump-out chamber with level controls. The pumped effluent can be routed through Highland's Advanced Filtration System to further reduce the oil content.



Model HT or HTC	Flow Rate Gal/Min	Recommended Oil Pump Out Gallons	Total Volume Gallons	Inlet/ Outlet Diameter	Dimensions			
					Diameter	HT or HTC Length	Series G Length	Series J Length
350	35	70	350	4"	3'-6"	6'-0"	9'-9"	9'-0"
550	55	110	550	4"	3'-6"	7'-9"	10'-9"	10'-9"
1,000	100	200	1,000	6"	4'-0"	10'-9"	14'-0"	14'-0"
2,000	200	400	2,000	6"	5'-4"	12'-0"	15'-0"	15'-3"
3,000	300	600	3,000	8"	5'-4"	18'-0"	21'-4"	21'-4"
4,000	400	800	4,000	8"	5'-4"	24'-0"	28'-8"	28'-8"
5,000	500	1,000	5,000	8"	6'-0"	23'-10"	28'-8"	28'-8"
6,000	600	1,200	6,000	10"	6'-0"	28'-8"	34'-0"	34'-0"
7,000	700	1,400	7,000	10"	7'-0"	24'-4"	28'-8"	28'-8"
8,000	800	1,600	8,000	10"	7'-0"	28'-0"	33'-6"	33'-6"
9,000	900	1,800	9,000	12"	8'-0"	24'-0"	28'-8"	28'-8"
10,000	1,000	2,000	10,000	12"	8'-0"	26'-8"	32'-0"	32'-0"
12,000	1,200	2,400	12,000	12"	8'-0"	32'-0"	38'-9"	38'-9"
15,000	1,500	3,000	15,000	14"	10'-0"	25'-6"	32'-8"	32'-8"
20,000	2,000	4,000	20,000	16"	10'-6"	31'-0"	38'-9"	38'-9"
25,000	2,500	5,000	25,000	18"	10'-6"	38'-9"	46'-6"	46'-6"
30,000	3,000	6,000	30,000	20"	10'-6"	46'-6"	56'-2"	56'-2"
40,000	4,000	8,000	40,000	24"	12'-0"	47'-3"	56'-9"	56'-9"
50,000	5,000	10,000	50,000	24"	12'-0"	59'-6"	**	**
60,000	6,000	12,000	60,000	24"	13'-0"	60'-6"	**	**

Plate spacing and orientation may vary depending on site conditions. \*\* Contact Highland Tank for sizing information.

Please visit us at [www.separatoronline.com](http://www.separatoronline.com) • [www.highlandtank.com](http://www.highlandtank.com) • Email us at [wastewater@highlandtank.com](mailto:wastewater@highlandtank.com)



One Highland Road  
Stoystown, PA 15563  
814-893-5701  
FAX 893-6126

4535 Elizabethtown Road  
Manheim, PA 17545  
717-664-0600  
FAX 664-0617

958 19th Street  
Watervliet, NY 12189  
518-273-0801  
FAX 273-1365

2225 Chestnut Street  
Lebanon, PA 17042  
717-664-0602  
FAX 664-0631

2700 Patterson Street  
Greensboro, NC 27407  
336-218-0801  
FAX 218-1292

1510 Stoystown Road  
Friedens, PA 15541  
814-443-6800  
FAX 444-8662



**Section 12.7.5      Instrument Air Compressor (See Next Pages)**





**Presented to:**

**Prepared by:**  
**David Gaede**

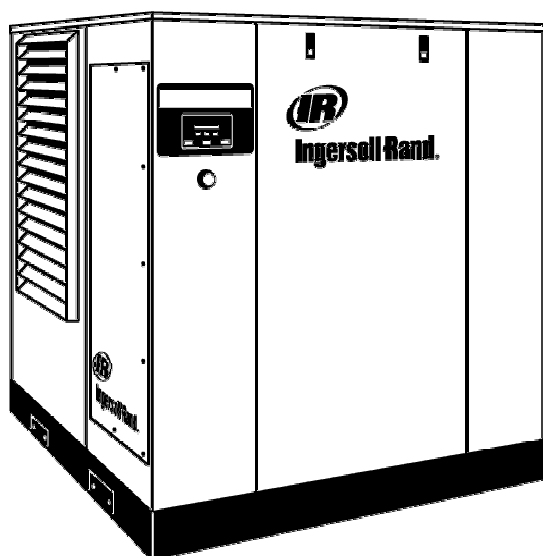
Sales Consultant - Air Systems  
Duncan Industrial Solutions  
Tulsa, OK 74146  
Direct: 800-375-5678 ext 8634  
Fax: 405-488-3934

**Proposal: 91906DG5**  
**September 19, 2006**

## EPE 50

### *Detailed Scope of Supply*

All amounts are displayed in US dollars



#### **Technical Information:**

Capacity- 185 cfm @ 125 PSIG

Maximum Operating Pressure- 128 PSIG

Weight- 2,000 lbs

Outlet Size- 1.5 " NPT

Dimensions- Facing control panel\*

(L\* x W x H)- 64"x 67"x 67"

Package Amp Draw Table-

200/3/60- 158.8 Amps 230/3/60- 137.6 Amps

460/3/60- 69.3 Amps 575/3/60- 55.5 Amps

Sound Level- per CAGI-PNEUROP PN2CPTC2

Standard enclosure- 85 dBA

Low sound enclosure- 75 dBA

Aftercooler CTD- 15 °F

Fan Air Flow- 6,700 cfm

**Items as specified below**

<u>QTY</u>	<u>Description</u>	<u>Unit Price</u>	<u>Total Price</u>
1	SSR EPE-50 Rotary Screw Air Compressor		
1	460V Open Drip Proof Full Voltage Motor/Starter		Included
1	Aircooled Aftercooler		Included
	The SSR 50-100Hp compressor utilizes a swing-out cooler. This unique design facilitates cooler access and provides a simple means of collecting and disposing of dirt and debris. The design also enables the package to run cooler.		
1	Intellisys Controller		Included



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## EPE 50

The Intellisys microprocessor utilizes a finger-touch membrane panel providing access to all adjustments and key operating parameters. By automatically warning and/or stopping the compressor, Intellisys then displays the problem eliminating costly troubleshooting and minimizing downtime. Intellisys provides five display standards, four adjustable operating parameters, two fault warnings and eight fault shutdowns.

1	3 Micron Air Filter	Included
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Ingersoll-Rand air compressors are supplied with air filters that are 99.9% efficient at 3 micron and above.

1	Sound Attenuating Enclosure	Included
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Panels come with quick release latches for easy removal and maintenance. All panels are protected by a high quality powder coat finish.

1	Standard Factory Warranty	Included
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The Company warrants that the equipment manufactured by it and delivered hereunder will be free of defects in material and workmanship for a period of twelve months from the date of placing the Equipment in operation or eighteen months from the date of shipment from the factory, whichever shall first occur. The Purchaser shall be obligated to promptly report any failure to conform to this warranty, in writing to the Company in said period, whereupon the Company shall, at its option, correct such nonconformity, by suitable repair to such equipment or, furnish a replacement part F.O.B. point of shipment, provided the Purchaser has stored, installed, maintained and operated such Equipment in accordance with good industry practices and has complied with specific recommendations of the Company. Accessories or equipment furnished by the Company, but manufactured by others, shall carry whatever warranty the manufacturers have conveyed to the Company and which can be passed on to the Purchaser. The Company shall not be liable for any repairs, replacements, or adjustments to the Equipment or any costs of labor performed by the Purchaser or others without Company's prior written approval. The effects of corrosion, erosion and normal wear and tear are specifically excluded. Note that this is Ingersoll\_Rand standard warranty. Any warranty in force at the time of purchase of the compressor or negotiated as part of the purchase order may take precedence over this warranty.

1	Modulation Control	Included
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Upper Range Modulation adjusts the flow between 60% and 100% of rated capacity to match the system demand, dramatically increasing airtend life.

1	Ultra Coolant	Included
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## EPE 50

SSR Ultra Coolant is a lubricant specifically formulated for use in the SSR air compressor. The lubricant qualities of this coolant far exceed petroleum base and other synthetic oils. Ultra Coolant has a lifetime of two (2) years or 8000 hours, whichever comes first.

1	Nema 1 Fusible Disconnect W/ Fuses	Included
	Shipped Loose	

## TZ220 Heatless Desiccant Dryer

### *Detailed Scope of Supply*

All amounts are displayed in US dollars



TZ500 - Shown do not use for construction

#### **Technical Information:**

Capacity- 220 scfm

Dewpoint- -40 °F

Maximum Operating Pressure- 150 PSIG

Weight- 640 lbs

Inlet/Outlet Size- 1-1/2" NPT

Dimensions- (W x D x H)- 41" x 22" x 83"

Desiccant Volume/Vessel- 2.63 Ft<sup>3</sup>

Lb. Desiccant/Vessel- 126

Amp Draw Table-

115/1/60- 1 Amp

Capacity rating is based on following:

100 psig, 100° F inlet air, 100° F ambient

**Items as specified below**

<u>QTY</u>	<u>Description</u>	<u>Unit Price</u>	<u>Total Price</u>
1	TZ220 Heatless Desiccant Dryer		
1	110/1/60		Included
1	Standard Factory Warranty		Included

---

## TZ220 Heatless Desiccant Dryer

The Company warrants that the equipment manufactured by it and delivered hereunder will be free of defects in material and workmanship for a period of twelve months from the date of placing the Equipment in operation or eighteen months from the date of shipment from the factory, whichever shall first occur. The Purchaser shall be obligated to promptly report any failure to conform to this warranty, in writing to the Company in said period, whereupon the Company shall, at its option, correct such nonconformity, by suitable repair to such equipment or, furnish a replacement part F.O.B. point of shipment, provided the Purchaser has stored, installed, maintained and operated such Equipment in accordance with good industry practices and has complied with specific recommendations of the Company. Accessories or equipment furnished by the Company, but manufactured by others, shall carry whatever warranty the manufacturers have conveyed to the Company and which can be passed on to the Purchaser. The Company shall not be liable for any repairs, replacements, or adjustments to the Equipment or any costs of labor performed by the Purchaser or others without Company's prior written approval. The effects of corrosion, erosion and normal wear and tear are specifically excluded. Note that this is Ingersoll\_Rand standard warranty. Any warranty in force at the time of purchase of the compressor or negotiated as part of the purchase order may take precedence over this warranty.

Fusible Disconnect (Shipped Loose)	Included
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Dual Mounted Filter Option W/9 Valve Bypass	Included
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1	HE & DP Filters	Included
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1	IRGP275 General Purpose Coalescing/Particulate Filter	
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GP - General Purpose Filter designed to remove bulk particles (1 micron and larger) and oil (.5 mg/m3) at rated conditions. Primary purpose is to protect down stream filtration and drying equipment from large contaminants.



## **400 Gallon, 200 Psig Vertical Tank**

The Company warrants that the equipment manufactured by it and delivered hereunder will be free of defects in material and workmanship for a period of twelve months from the date of placing the Equipment in operation or eighteen months from the date of shipment from the factory, whichever shall first occur. The Purchaser shall be obligated to promptly report any failure to conform to this warranty, in writing to the Company in said period, whereupon the Company shall, at its option, correct such nonconformity, by suitable repair to such equipment or, furnish a replacement part F.O.B. point of shipment, provided the Purchaser has stored, installed, maintained and operated such Equipment in accordance with good industry practices and has complied with specific recommendations of the Company. Accessories or equipment furnished by the Company, but manufactured by others, shall carry whatever warranty the manufacturers have conveyed to the Company and which can be passed on to the Purchaser. The Company shall not be liable for any repairs, replacements, or adjustments to the Equipment or any costs of labor performed by the Purchaser or others without Company's prior written approval. The effects of corrosion, erosion and normal wear and tear are specifically excluded. Note that this is Ingersoll\_Rand standard warranty. Any warranty in force at the time of purchase of the compressor or negotiated as part of the purchase order may take precedence over this warranty.



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## Quote Summary

All amounts are displayed in US dollars

Qty	Description	Unit Price	Total Price
2	EPE 50		
1	TZ220 Heatless Desiccant Dryer		
2	400 Gallon, 200 Psig Vertical Tank		

### Comments

Certified Drawings (11" X 17") will be \$200 per copy.

Delivery: 4-6 Weeks

Payment Terms: Net 30 Days

FOB: Shipping Point

Freight Terms: Prepaid and Add

Pricing and availability are subject to change without notice



**Section 12.7.6      Plant DCS System (Later By ProEnergy EPC)**