

# TECHNICAL SCOPE DOCUMENT

Presented To:

**C.A. La Electricidad de Caracas**

For:

**LM6000 PC & PD Plant with Inlet Chilling**

**La Raisia Power Plant Phase 2**

By



Proposal T-9036

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EDC

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## **Section 1.0 Introduction**

Derwick Associates Corp. (Contractor) is pleased to provide this Technical Proposal to install a nominal 98 MW Gas Turbine Simple Cycle Power Plant addition to the LaRaisa Power Plant.

This fast-track, with three steps of approval made by the owner or the owner's representative, proposal includes installing the following Owner supplied equipment:

- One (1) gas fueled GE LM 6000PC gas turbine generator package
- One (1) gas fueled GE LM 6000PD gas turbine generator package

Contractor will furnish all engineering, required balance of plant equipment, contract locally for the required subcontractors to accomplish the site construction, construction tools, equipment rental and project management.

Contractor will furnish commissioning, start-up, and performance testing services for the LM6000PC unit. The contractor will also bring in GE or qualified service provider to commission the LM6000PD. However, commission of the PD is much more complicated than the PC machine and will require much more time to complete.

This Technical Scope Document will become an exhibit to the EPC Contract.

### **Water Pipeline**

**Contractor through the use of a qualified local subcontractor will also construct a water supply pipeline to the site based on the specifications provided by EDC and Asincro. Unlike the balance of the project, the construction of the pipeline will be furnished on a Cost Plus Basis based on the labor and materials used to construct the pipeline. The definition of the pipeline scope of supply is not included in the various sections of this TSD document. The final scope will be provided following the selection of the pipeline contractor.**

**This Technical Scope Document will become an exhibit to the EPC Contract.**

**THIS DOCUMENT IS CONFIDENTIAL. IT IS DESIGNED AND INTENDED FOR EDC'S USE. THIS DOCUMENT IS FOR THE SOLE PURPOSE OF EVALUATING CONTRACTOR'S PROPOSAL FOR THE (1) GE LM 6000 PC AND (1) GE LM 6000 PD POWER PROJECT ADDITION.**

**Section 2.0 Scope of Work and Equipment**

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

**Major Generation Equipment**

The installation of (1) each Owner Supplied GE LM 6000 PC gas turbine generator package and (1) Owner Supplied GE LM6000 PD gas turbine generator package. The units are complete with turbine control panels, auxiliary skids and inlet filters. Note: These units do not include motor control centers, modular control rooms or exhaust stacks. These will be included and installed in the balance of plant supplied by the Contractor.

GE LM 6000 interface points are as follows:

<b>Equipment System</b>	<b>General Electric</b>
<ul style="list-style-type: none"><li>• All supply piping, including Fuel Gas, Demineralized Water, Lube Oil, Compressed Air, Instrument Air, and Inlet Air Chilling</li></ul>	<ul style="list-style-type: none"><li>• Flanged or threaded connection on GE LM 6000 GTG base plates.</li></ul>
<ul style="list-style-type: none"><li>• Inlet Air-to-Filter</li></ul>	<ul style="list-style-type: none"><li>• Atmosphere</li></ul>
<ul style="list-style-type: none"><li>• Turbine/Generator Ventilation Air</li></ul>	<ul style="list-style-type: none"><li>• Atmosphere</li></ul>
<ul style="list-style-type: none"><li>• Turbine Exhaust</li></ul>	<ul style="list-style-type: none"><li>• Flange &amp; Expansion Joint for connection to Exhaust Stack for both PC and PD</li></ul>
<ul style="list-style-type: none"><li>• Instruments on the LM 6000 Base plate</li></ul>	<ul style="list-style-type: none"><li>• Terminal box on base plate</li></ul>
<ul style="list-style-type: none"><li>• Instrument wiring in Turbine Control Panel</li></ul>	<ul style="list-style-type: none"><li>• Terminal in Turbine Control Panel</li></ul>
<ul style="list-style-type: none"><li>• High Voltage Connections</li></ul>	<ul style="list-style-type: none"><li>• Bus bar in LM 6000 generator line side cubicle</li></ul>
<ul style="list-style-type: none"><li>• Generator Ground Connections</li></ul>	<ul style="list-style-type: none"><li>• LM 6000 Neutral cubicle</li></ul>
<ul style="list-style-type: none"><li>• Electric Motors</li></ul>	<ul style="list-style-type: none"><li>• With cables &amp; conduits from Control Module</li></ul>
<ul style="list-style-type: none"><li>• Ladders and Platforms for Air Filter</li></ul>	<ul style="list-style-type: none"><li>• Ladders and Platforms for Inlet Air Filter and Vent Fans</li></ul>

## **2.0 Balance of Plant**

The contractor will design and install the facility as described in the following sections of this document and as clarified in the associated Clarification Document included in Section 12. The design will include the necessary Structural, Mechanical, Electrical, Instrumentation, and Control System to install the above Major Equipment.

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

- Contractor will provide complete design of the facility including civil, structural, buildings, mechanical, electrical, instrumentation and control
- Contractor will provide concrete foundations, plant gravel, and access roads
- Owner is providing a reasonably level site which Contractor has visited and based its plant layout on
- Owner is providing an entrance road to the site which Contractor has visited.
- Owner will provide (2) 13.8 KV to 230 KV, 60 to 75 MVA GSU Transformers
- Contractor will provide Installation of the complete Power Plant with the inter-ties as described later in this document and including:
  - Mechanical installation of the various items of equipment with the associated inter-ties of gas fuel, sanitary sewer, waste water, demin water, waste oil, drainage.
  - Electrical installation of the plant including the 13.8Kv interconnect cable, plant electrical for BOP equipment, area lighting, grounding, lightning protection, and cathodic protection
  - Installation of Instrumentation, Control and Protection System including plant instrumentation, metering, and Plant remote DCS

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

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

The Contractor will supply and install 45 ft. exhaust stacks in accordance with the standards set out by GE for each LM 6000 machine.

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

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

- Interconnect to header near PDVSA gas metering station above ground at the Plant boundary as described on the Plot Plan
- Install two (2) redundant coalescing filter separators on a common skid including redundant pressure regulators
- Furnish and Install the fuel gas compression plant with two (2) ea. 100% Gas Compressors to raise the available supply pressure to the required 675 - 681 psig for the PC and PD respectively, supply pressure to the gas turbines.

- Install all plant fuel gas carbon steel piping, valves and fittings from plant inlet fuel gas interconnect to the fuel gas regulator filter
- Install stainless steel piping from the fuel gas filter to the gas turbine generator

### **2.1.3 Water and Demineralized Water System**

Contractor will Supply and install the plant Water Treatment System expansion outlined as follows:

#### **Contractor Supplied Equipment**

- Supply and Install an expansion (demin water modules shall be similar to existing demin modules of P&W FT8) to the Multi-Media filter and R.O. systems
- Supply and install GE EDI Demineralized system addition as required to meet the GE engine specification
- Provide and Install two (2) 50% capacity Demin water forwarding pumps and one (1) spare pump of 50% capacity for 3x50%
- Provide and install two (2) 100% capacity Demin Water filter/regulator duplex type skids
- Provide and install all plant Demin water Stainless steel piping, valves and fittings from the plant Demin Water storage tanks, to the Demin injection pumps and to the (2) Demin water injection connections at each of the GE LM 6000 GTGs
- Provide and install 3x50% raw water pumps
- Provide and install 275,000 gallons stainless steel demin tank.

### **2.1.4 Oily Water Drain System – as provided with FT8 Plant**

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

- Furnish and install PVC or HDPE below ground piping and fittings from concrete oil containment units located at:
  - 1) All Transformers
  - 2) Gas Turbine Generator Auxiliary Skids and Gas Turbine Generator Drains Pip-

ing is to be routed to the oily water separator and then to the waste oil storage tank. Provisions are to be made to pump out the waste oil to a truck for disposal, which will be provided by the Owner.

### **2.1.5 Plant Fire Water System**

The Contractor will furnish and install a header expansion to the Firewater System that includes:

- Furnish and Install headers in accordance with NFPA Codes and PDVSA standards. All piping to be carbon steel.
- Monitors and Hydrants installed in accordance with NFPA Codes and PDVSA standards.
- Portable fire extinguishers as required according to PDVSA standards.

- Water spray systems for transformers.

#### **2.1.6 Instrument and Service Air Systems**

The instrument and service air systems will be as follows:

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

### **2.2 BOP Electrical Systems**

#### **2.2.1 13.8 KV System**

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

- Install two (2) Contractor furnished 13.8 KV 3,000 amp generator circuit breakers with PTs and CTs
- Furnish and install all 13.8 KV cabling, bus work, cable tray etc. from the generators to the generator circuit breakers.
- Furnish and install two (2) 13.8 KV 1200 A Feeder Breakers
- Furnish and install all five (5) circuit breakers for auxiliary transformer
- Furnish and install four (4) 13.8KV / 480 volt auxiliary power transformer

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

The contractor to provide the following:

- Furnish and install one (1) 13.8KV / 4160V auxiliary power transformer for the gas compressors.
- Supply one (1) spare 13.8KV / 4160V auxiliary power transformer for the gas compressors.
- Furnish and install four (4) 13.8KV / 480 volt auxiliary power transformer.
- Furnish and install one (1) 4160 V MCCs for Ariel Gas Compressors.

#### **2.2.3 480V System**

The Contractor will provide the 480V system as follows:

- Furnish and install one (1) 480 V water MCC
- Furnish and install two (2) 480 V GTG MCC

- Furnish and install one (1) 480V Gas Compressor MCC with two (2) starters
- Furnish and install cable tray / conduit with cabling from transformers to MCCs and from MCCs to plant 480V equipment and motors
- Furnish and install underground conduit, duct banks, or overhead cable tray mounted on the pipe racks

**2.2.4 120/208 System**

The Contractor will provide the 120/208 system as follows:

- Furnish and install 480V/120/208V transformers, distribution panels and lighting panels as required with associated conduits, fittings and wire.

**2.2.5 Plant Area Lighting**

The Contractor will provide the plant area lighting as follows:

- Furnish and install area lighting consisting of two (2) 25 ft galvanized metal poles with two (2) 400 watt high pressure sodium floodlights on each pole sufficient to illuminate both GTG's and common areas to 50 lux

**2.2.6 Ground Grid**

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

- Furnish and install plant ground grid expansion with associated ground rods and connections to plant equipment, buildings and fence in accordance with Paragraph 12.2.21 of the EDC specification according to IEEE 665

**2.2.7 Plant Electrical Cable Tray**

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

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

**2.2.8 Underground Conduit and Cable Systems**

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

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



**2.2.9 Lightning Protection**

The Contractor will provide lightning protection as follows:

- Furnish and install lightning protection on each gas turbine exhaust stack. Also install protection on all buildings, structures, etc. within the project area that needs to be protected against a lightning discharge.

**2.2.10 Batteries / Chargers / UPS Systems**

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

- Furnish and install BOP UPS system for remote Distributed Control System (DCS) and associated equipment
- Furnish and install one (1) 125V DC battery and charger for 13.8KV plant switchgear

Note: 24 VDC batteries and chargers are to be supplied as part of the GE LM 6000 package

**2.3 Plant Instrument and Control Systems****2.3.1 BOP Control System**

The Contractor will furnish and install a BOP control system consisting of:

- One (1) new Distributed Control System (DCS) system expansion and HMI's to be located in the main control room. The DCS shall integrate turbogenerators, BOP and auxiliary systems (dedicated consoles will not be used)
- Provide and install remote PLC panels as required in certain areas of the site and interfaced back to the main control room DCS
- Two (2) GE package supplied HMI's to interface with DCS System. There will be a remote panel to control the two (2) gas turbines
- 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
- New DCS shall include all the new configuration for the existing three (3) P&W turbines, the two (2) GE 7EA turbines, the two (2) LM6000 turbines and all BOP equipment in La Raisa plant.
- 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.
- Gas detectors to be located in plant area per applicable codes and standards. (Natural Gas supply is not odorized).

**2.3.2 Plant Instrumentation Devices**

- Gas Turbine Control Panel is supplied with each LM6000 gas turbine mounted in Control Module supplied by GE
- Contractor to furnish and install instrument devices, both pneumatic and electric, consisting of meters, pressure, flow, temperature and level where required

**2.3.3 Electronic Wiring and Pneumatic Piping**

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

**2.4 230 KV Substation – Not Included: Contractors Scope stops at high voltage side of the transformer (high voltage 230 kV bushing). Contractor shall install the transformers and accessories.****2.4.1 Generator Step-up Transformers (GSUs)**

- Contractor to install two (2) each Owner Supplied 60 to 75 MVA generator step-up transformers with 13.8KV delta to 230 KV wye windings

**2.4.2 Protective Relaying**

- Contractor to supply and install protective relay panel for the GSU transformers and provide interface points for other substation protective relay equipment provided by Owner

**2.4.3 Site Work**

- Contractor to prepare the site and provide the following:
  - Foundations for the GTGs, fuel and water tank area, GSU transformers, buildings, truck off-load and three (3) gas compressor
  - Driveways and roads
  - Gravel

**2.5 Plant Communication System**

- Contractor to provide communication and public address system for the new plant in accordance with 16.10 & 17 of the terminos de referencia.
- Contractor to furnish temporary telephones and email capability for construction communication purposes.
- Permanent telephone lines for operation of the plant will be provided by Owner.

**2.6 Plant Civil and Structural**

- Site preparation, rough grading, and finished grading to be furnished by Contractor based on an existing site requiring minimal cut and fill.
- Contractor to furnish and install all plant reinforced concrete foundations designed to IBC 2003 as per COVENIN standards for Industrial Buildings and Seismic Foundations. GSU foundation shall have 9" freeboard.
- Contractor to furnish and install concrete containment curbs and equipment foundations, including liquid fuel offloading area.
- Contractor to furnish and install plant gravel and asphalt paving as shown on the Plot Plans.
- Contractor to provide structural steel pipe racks to support overhead piping and cable trays. Pipe racks to be located as shown on Plot Plan drawings.

**2.7 Plant Buildings**

Contractor to furnish and install:

- Demin Water Treatment Building expansion
- Gas Compressor Shed expansion
- Electrical / Control Building with pump shed

**2.8 Plant Equipment Erection**

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

**2.9 Cranes, Equipment and Tools**

Contractor to furnish or provide for all plant construction required cranes, fork lifts, back hoes, hydraulic lifts, welding machines, air compressors, generators, temporary lights, trucks, pick-ups, etc.

**2.10 Transportation**

Contractor will provide the transportation of the BOP equipment to site.

**2.11 Lubricants and Chemicals**

- Contractor will supply and install all lubricants, lube oils and chemicals for furnished equipment.
- Contractor to supply and install non-PCB oil for GSU transformers.
- Contractor will supply all consumables and spare parts during start up and commissioning.

**2.12 Construction Offices and Storage Facilities**

- Contractor to provide construction offices for Contractor, Technical Representatives (3), and Owner.
- Owner is providing the site which has sufficient lay down area and site for construction offices and construction utilities (electrical and potable water)
- Contractor to provide fenced storage and a lay down area and around the construction site during construction.
- Contractor to provide sanitation facilities for Contractor, & Owner personnel during construction.
- Contractor to provide communication facilities for construction.

**2.13 Engineering and Project Management**

- Contractor to provide detailed engineering (drawings and documents) and specifications for all disciplines involved for the power plant including civil and concrete foundations.
- Contractor to provide engineering (drawings and documents) for approval of EDC, if not approved in 5 calendar days Derwick will not be responsible for the completion of the project in the stipulated time.
- Contractor to provide project management complete with construction management, quality control / quality assurance, scheduling, administration, warehousing, health safety and environment (HSE) supervisors as required by Venezuelan laws and expediting including regular monthly reporting of all disciplines.
- Contractor will provide engineering submittals for La Raisa II.
- Contractor to arrange for and provide fully qualified technical representatives during erection, testing, start-up, commissioning for the LM6000PC gas turbine generator unit and Chillers. Contractor will also contract with GE for the commissioning, start-up and testing of the LM6000PD package.
- Contractor to provide startup, commissioning and testing of BOP associated systems.
- Contractor to provide O&M service and technical support for at least 6 months after C/O.
- Contractor to provide operator and maintenance training for Power Plant on the Gas Turbine Generator Packages and Balance of Plant.
- Contractor to provide one (1) electronic and two (2) hard copies in English and Spanish of the O&M manuals, training manuals, engineering calculations, commissioning and start-up

manuals, test manuals, as-built drawings, design specifications and warranty manuals for plant equipment.

#### **2.14 Cathodic Protection**

Cathodic Protection will be provided for all steel underground piping and tanks.

#### **2.15 Spares**

Contractor shall supply, receive and store all consumables and commissioning spare parts furnished for equipment during start up and commissioning.  
Contractor to provide Owner with recommended list of spare parts for the BOP equipment supplied by Contractor.

### Section 3.0 Balance of Plant Equipment Supply Matrix

Material/Responsibility	Qty	Description
<b>Owner</b>	1 Lot	Removal of all unused building foundations, underground piping, etc. on the proposed project site
	1 Lot	Natural Gas Pipeline and supply metered at inter-tie point within 50' of Plant Boundary. Connection will be in a header tie in.
	1 Lot	Fuel Gas for Commissioning / Start-up that meets GE Fuel Specifications
	1 Lot	Raw Water Supply to site boundary
	1 Lot	Raw Water for Commissioning and Startup
	1 Lot	Waste Water and Waste Oil Truck Removal
	1 Lot	Permits for Environmental, Importation, Transportation, Building, Operations, etc. to allow plant construction and commercial operations
	1 Lot	Construction Commissioning 480V three phase power
	1 Lot	Access Roads to site
	1 Lot	Any required Electric Utility 13,8KV to 230 KV Tie-In interconnect to the Utility
	1 Lot	Import Duties and Taxes
	1 Lot	Construction lay down area as available on the existing site
	1 Lot	Right of Way, easements, etc. to allow proposed interconnects as required
		<b>Gas Turbine Generator</b>
	2	GE Frame LM6000 PC (60Hz) Gas Turbine Generator packages
	2	Turbine Control Panels
	2	Generator Control Panels and Protection Panels - 24 VDC Batteries and Chargers
	2	13.8 KV to 230 KV GSU Transformers , 60 – 75 MVA
<b>Contractor – Responsibility Civil / Structural</b>	1 Lot	Site Soil Borings & Studies to design Foundations
	1 Lot	Site Preparation, Rough Grading, Excavation, final grading and fencing
	1 Lot	Temporary Power Distribution
	1 Lot	Plant Concrete Foundations
	1 Lot	Plant Paving, Gravel and Pads for the GTG Turbines and Generators
	1 Lot	Structural piping supports, platforms, ladders, and Misc structural steel supports. (Note: Platforms and ladders for the exhaust stacks to be furnished by Owner)
	1 Lot	Erection of (1) Owner Furnished LM6000 PC and (1) Owner Furnished LM6000 PD Gas Turbine Generator with their associated accessories.
	1 Lot	Erection of Contractor Supplied Exhaust Stacks.

**Buildings**

- 1 Demin Water Treatment System expansion & Forwarding Pump Building expansion
- 1 Gas Compressor shed expansion
- 1 Control Room, Electrical building and pump shed
- 1 Water Treatment Building expansion (Fire Water pumping Station Shed Expansion)

**Mechanical**

- 2 Exhaust 45' Stacks with Silencers
- 2 100 % Fuel Gas Compressors, one for each turbine
- 1 Fire Water System expansion including, Loop, Monitors and Hydrants
- 1 Duplex Instrument Air Compressor
- 2 GTG Duplex Demin Water Filter Skids
- 1 Water Treatment System expansion consisting of Multi-Media filters R.O. System
- 2 Demineralized Water Treatment system (EDI) expansion
- 3 Demin Water forwarding Pumps
- 1 Lot Pipe, Valves and Fittings with Insulation as required
- 1 Lot Mechanical Labor
- 3 50% raw water pumps
- 2 Demin water filter/regulator skids
- 1 275.000 gallons stainless steel demin tank

**Electrical**

- 2 13.8KV 3000 Amp, NEMA 3R Generator Breakers
- 5 13.8 KV Circuit breakers (Station Service) NEMA 3R
- 2 13.8 KV/4160 V 1500 KVA auxiliary power transformers for the Fuel Gas Compressor
- 4 13.8 KV/480 V 500 KVA Transformers
- 1 4160 V MCC for Fuel Gas Compressor
- 2 480 V GTG MCC's
- 1 480 V Water MCC
- 1 480 V Gas Compressor MCC
- 1 Lot BOP 480/220 V Transformers, Lights, Panels etc
- 1 120 V UPS System for Control Room
- 1 Plant Grounding Grid
- 1 Lot 125 VDC Battery & Charger
- 1 Lot Lightning Protection 50 lux
- 1 Lot Cathodic Protection for underground steel piping
- 1 Lot Area Lighting (50 lux)
- 1 Lot 480 V Welding Receptacles
- 1 Lot Electrical Labor
- 1 Lot Local Subcontractor(s) Civil, Electrical & Mechanical Craft Labor

**Construction**

- 1 Lot Major Equipment Erection
- 1 Lot Mechanical Installation and Construction
- 1 Lot Construction Tools, Rental Equipment & Rental Cranes
- 1 Lot Lubricants, Chemicals, Filters, etc. for Plant Commissioning and Start up
- 1 Lot Transportation of all BOP Equipment to site
- 1 Lot Plant Commissioning and Performance Testing
- 1 Lot Overall Plant Training

**Engineering**

- 1 Lot Conceptual and Detail Design engineering (Total Plant)
- 1 Lot Project Manuals including O&M, Warranty, and Engineering Calculations
- 1 Lot As Built Drawings
- 1 Lot Recommended Vendor Spare Parts List

**Instrumentation &  
Control**

- 1 Lot Plant Instrumentation
- 1 Remote DCS
- 1 Lot I&C Installation and Construction

**Material/Responsibility  
Contractor (continued)  
Project Management**

- | Qty   | Description  |
|-------|--|
| 1 Lot | Project Management with QA/QC, Safety, and Training  |
| 1 Lot | Construction Permits   |
| 1 Lot | Local Business Taxes   |
| 1 Lot | Project manuals including project procedures, Systems Turnover Manuals, project implementation, QA/QC, safety and training |
| 1 Lot | Training of Operators for the LM 6000 GTGs and BOP   |



## Section 4.0 Design Basis and Interconnect Points

### 4.1 Design Conditions

#### Design Conditions

Site Elevation (Meters above Mean Sea Level)	283.6
Multi-year median temperature:	27.5°C
Maximum dry bulb temperature:	33°C (95°F)
Maximum wet bulb temperature:	28.3°C (82.94°F)
Multi-year median relative humidity:	69%
Median annual precipitation:	813mm (32 in)
<b>(Majority during the months of October and November)</b>	
Predominant wind direction:	Northeast
Maximum average multiannual wind velocity:	78km/h
Seismic Zone	4
Fuel Gas Supply Pressure	250 psig minimum
Plant Gas Fuel Consumption Rate (2) LM6000	20.8 mmscfd *
High Voltage Interconnect @ GSU Bushings	230KV Substation (By Owner)
Instrument Air System add	185 scfm by Contractor
Demin Water required add	65 gpm
Demin Water Storage - existing	1,000 m <sup>3</sup> (275,000 gal)
Raw Water Storage (Includes Fire water) existing	2,400 m <sup>3</sup> (675,000 gal)
Raw Diesel Fuel Storage existing	5,000 m <sup>3</sup> (2 x 675,000 gal) existing
Clean Diesel Fuel Storage (2) existing	3,000 m <sup>3</sup> (2 x 275,000 gal) existing
Demin Water Storage - add	1,000 m <sup>3</sup> (275,000 gal)

\* assumes 900 - 1050 BTU/SCF natural gas quality

### 4.2 Interconnect Points

#### Interconnect Points

Fuel Gas	250 psig at PDVSA Metering & Regulating Station within Site
Plant Waste Water	At existing waste water tank discharge pump
Plant Waste Oil	At existing waste oil tank discharge pump
230 KV	At GSU High Side Bushings
Raw Water Supply	At existing Raw Water Tank

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## Section 5.0 Expected Performance – Using Natural Gas – With/Without Chilling

La Raisa II

### Simple Cycle

Site Elevation 930.4 Feet

Design Temperature 81.5 F

Relative Humidity 69%

ID GTPRO

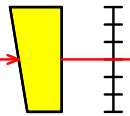
With Chiller

	330	332		330%	332	
	LM6000 PC SPT	LM6000 PD SPT	Total	LM6000 PC SPT	LM6000 PD SPT	Total
Chiller Tons	1503.7	1493	2996.7			
Cooling Load per GT	5012	4977	9989			
Temperature inlet	48	48	48			
Cooling Tower BTU/s	5955	6229	12184			
Chiller Water Recirc. GPM	1804.4	1433	3237.4			
Cooling Tower Recirc. GPM	1911.96	1898.4	3810.36			
Gross Power KW	49706	45604	95310	43994	40811	84805
Net Power KW	46973	43005	89978	42858	39776	82634
Aux & Losses KW	2733.4	2598.5	5331.9	1135.5	1035.2	2170.7
LHV Gross Heat Rate (BTU/kWh)	8533	8178	8355.5	8670	8414	8542
LHV Net Heat Rate (BTU/kWh)	9030	8672	8851	8899	8633	8766
LHV Gross Electric Eff %	39.99	41.73	40.86	39.36	40.56	39.96
LHV Net Electric Eff %	37.79	39.35	38.57	38.34	39.53	38.935
LHV Fuel (kBTU/h)	424148	372939	797087	381412	343370	724782
HHV Fuel (kBTU/h)	469577	412884	882461	422264	380147	802411
Fuel Gas (KPPH)	21.32	18.74	40.06	19.17	17.26	36.43
Fuel Gas (MMSCFD)	10.95	9.62	20.57	9.84	8.86	18.70
Water for Nox (KPPH)	22.46	0	22.46	17.53	0	17.53
Water for Nox (GPM)	44.94	0.00	44.88	35.07	0.00	35.03
SPT Water (KPPH)	8.352	6.73	15.08	8.743	8.66	17.405
SPT Water (GPM)	16.69	13.5	30.14	17.47	17.3	34.78

	GPM	GPD (24)	3 D	5D
RAW Water Total	230	331,729	995,188	1,658,647
Demin Water Total	75	108,122	324,366	540,609

	<b>LM6000 PC SPT</b>	<b>LM6000 PD SPT</b>	<b>Total</b>
Gas Fuel	11	10	21 (MMSCFD)
Demin Water for GF	62	13	75 GPM
RAW Water for GF	86	19	230 GPM

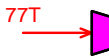
14.21 p  
82 T  
69 %RH  
1022.1 m  
930.4 ft elev.



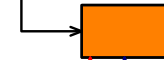
1X GE LM6000SPT

14.07 p  
48 T  
1012.9 m

8.352 m  
Natural gas 21.32 m  
LHV 424148 kBTU/h  
77 T



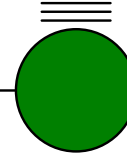
Water 22.46 m



180 T

1050.5 m

49706 kW

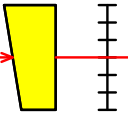


14.39 p  
834 T  
1050.5 M  
25 ppm NOx

Net Power 46973 kW  
LHV Heat Rate 9030 BTU/kWh

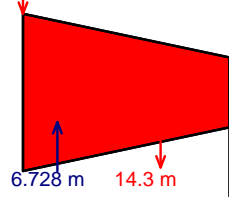
71.2 %N2  
12.55 %O2  
3.367 %CO2  
12.02 %H2O  
0.8559 %Ar

14.21 p  
82 T  
69 %RH  
1010.7 m  
930.4 ft elev.

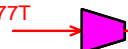


1X GE LM6000SPT

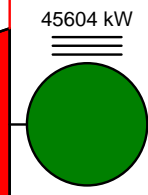
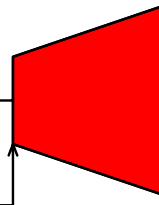
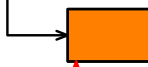
14.07 p  
48 T  
1001.7 m



6.728 m  
Natural gas 18.74 m  
LHV 372939 kBTU/h  
77 T



196 T



45604 kW

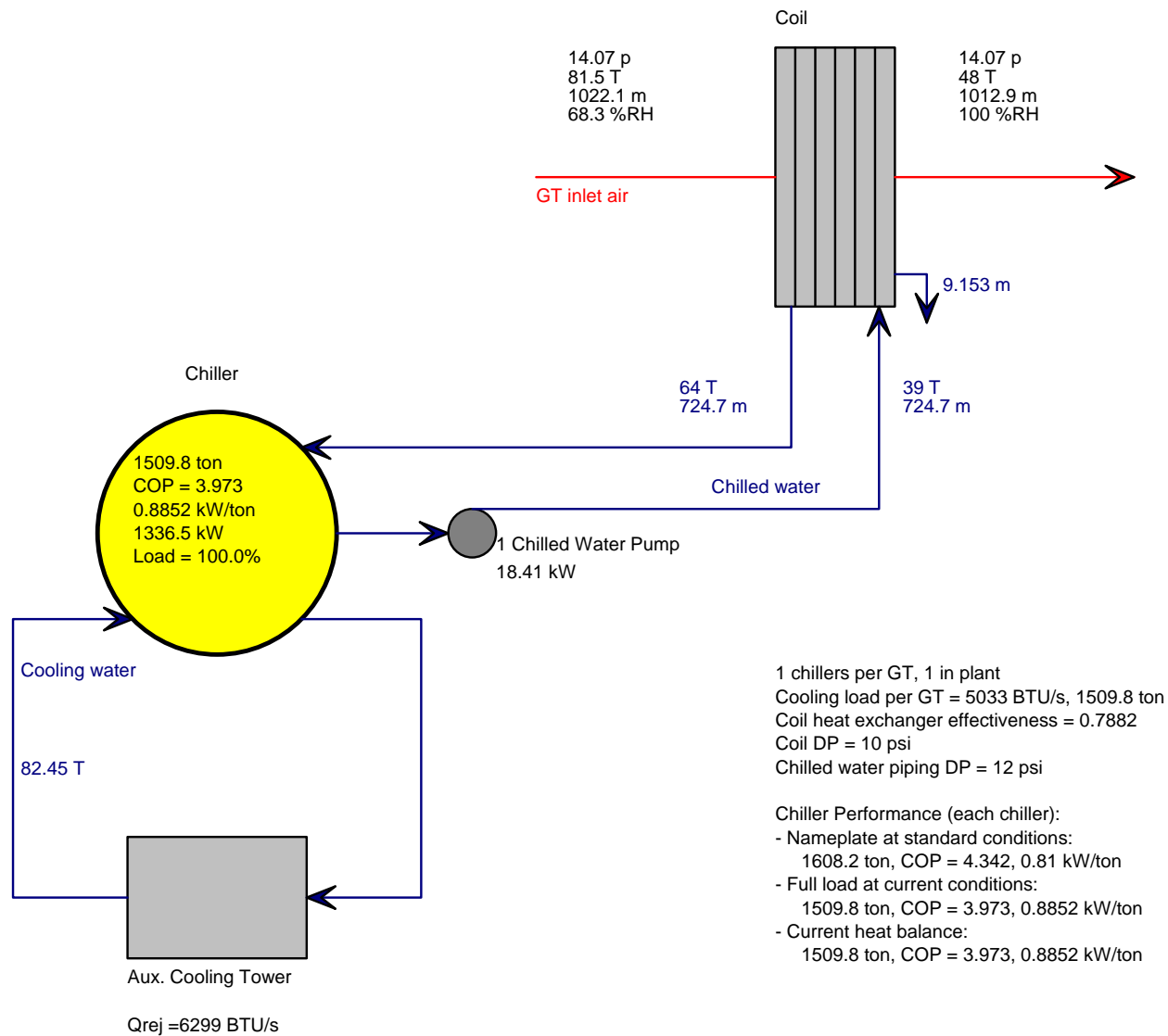
1012.8 m

14.39 p  
839 T  
1012.8 M

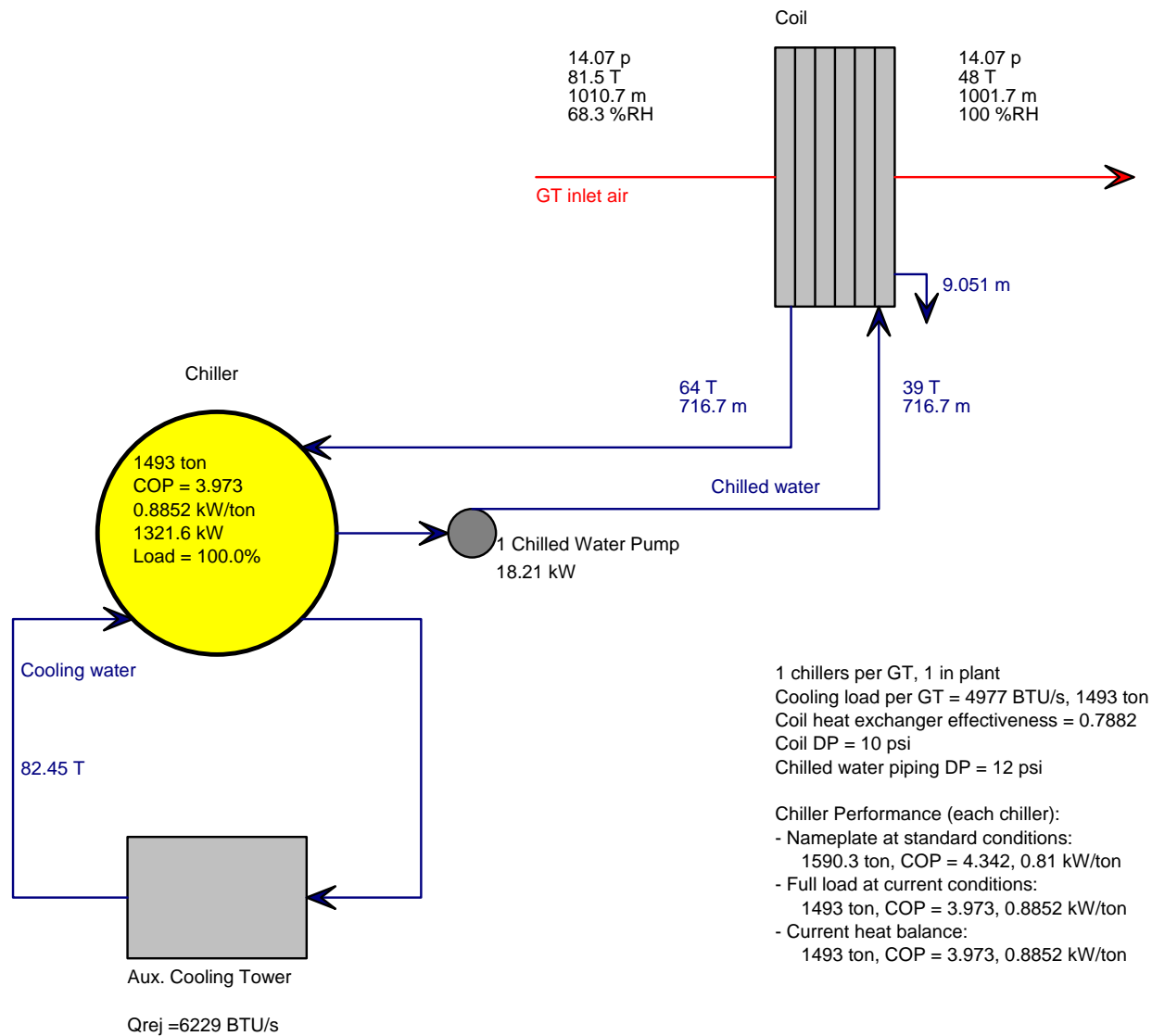
Net Power 43005 kW  
LHV Heat Rate 8672 BTU/kWh

74.09 %N2  
13.81 %O2  
3.118 %CO2  
8.085 %H2O  
0.8908 %Ar

# Water-Cooled Electric Chiller Circuit



# Water-Cooled Electric Chiller Circuit



14.21 p  
82 T  
69 %RH  
929.5 m  
930.4 ft elev.



14.07 p  
82 T  
929.5 m

8.743 m

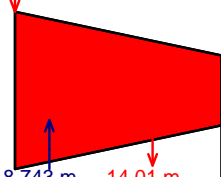
Natural gas 19.17 m  
LHV 381412 kBTU/h  
77 T



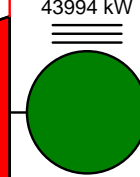
Water 17.53 m

180 T

1X GE LM6000SPT



14.01 m



43994 kW

960.9 m

14.39 p  
860 T  
960.9 M  
25 ppm NOx

Net Power 42858 kW  
LHV Heat Rate 8899 BTU/kWh

70.48 %N2  
12.49 %O2  
3.298 %CO2  
12.88 %H2O  
0.8475 %Ar



14.21 p  
82 T  
69 %RH  
918.1 m  
930.4 ft elev.



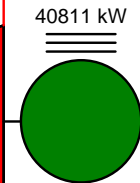
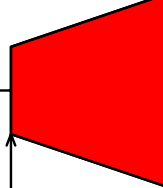
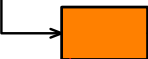
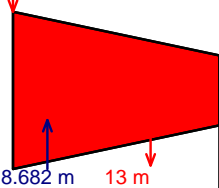
14.07 p  
82 T  
918.1 m

8.682 m 13 m  
Natural gas 17.26 m  
LHV 343370 kBTU/h  
77 T



196 T

1X GE LM6000SPT



40811 kW

931 m

14.39 p  
866 T  
931 M

Net Power 39776 kW  
LHV Heat Rate 8633 BTU/kWh

72.73 %N2  
13.48 %O2  
3.102 %CO2  
9.809 %H2O  
0.8746 %Ar

## **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 (TYPICAL & NOT PROJECT SPECIFIC)**

**A project specific plan will be submitted following the project kick-off.**

### **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
- HSE Supervisors

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

#### **7.1.2 Project Manuals**

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

- Project Procedures
- Project Implementation
- Project Engineering Calculations
- Project Warranties
- QA/QC
- Safety •  
Training

- Operation and Maintenance
- Commissioning, Start Up, and Turnover
- Project Performance Test

### **7.1.3 Project Schedule**

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

### **7.1.4 Project Engineering**

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

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

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

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

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

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

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

#### **7.1.5 Owner Approval**

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

#### **7.1.6 Project Procurement**

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

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

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

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

##### **1. Mobilization**

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

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

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

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

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

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

#### 4. Training

Training includes two (2) TA's in operation and maintenance during a twelve hour period and they will be available on call for the other twelve hour period.

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.

#### 6. Technical and O&M support is included after start up and during the period of 6 months during commercial operation.

## **8.0 PROJECT SCHEDULE**

A schedule and list of products will be supplied for each phase.

A Project Schedule for the installation of (1) LM6000 PC and (1) LM6000 PD Gas Turbine Generator will be provided following the project kickoff meeting.

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- III. PLAN TASKS AND PROCEDURES
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    - 3. Drawing Control
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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 fast-track with three steps of approval made by the owner or the owner's representative 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**

##### **.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. Equipment and material specification shall be provided to the client or client's representative for revision.

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. Vendor's bids shall be revised by the owner or owner's representative before purchase.

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. Vendor's bids shall be revised by the owner or owner's representative before purchase.

## **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-man-dated 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. Factor 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.



**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.
- Grain, density, humidity analysis of soil material shall be done before earth moving. Compaction analysis during the backfill shall be done for each compacted layer of 25 to 30 cms thickness.

**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**

- Soil study, including at least 3 borings in the centerline of major equipment foundation like the turbine generator shall be done in order the structural engineer may recommend the subsoil improvement of preparation.
- 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 and the selection of appropriate cement for concrete.
- Determine the level of acceptance of allowed slump and temperature for each concrete mixing truck. •  
Carry on the required concrete strength test at 7, 14 and 28 days of poured. •  
Carry out a conservative procedure of curing the concrete after poured, by adding appropriate additives to avoid concrete superficial cracks, and maintain a permanent wetting of concrete surface.
- 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. Confirm adequate insulation of cable terminals, to use thermo contractile sleeves for the cable terminations.
- 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**

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

**F. Piping and Welding**

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

**G. Instrumentation**

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

**H. Documentation**

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

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

## **VI. SHIPPING AND HANDLING**

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

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

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**PART 2 PROJECT SPECIFIC TEST AND INSPECTION PROCEDURES****I. SCOPE**

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

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

**II. STANDARDS AND CODES**

The following organization's standards and codes are applicable to design and construction practices for the project. PDVSA standards for fire systems will be included.

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
API 650	Tanks
IEEE Std. 665	Station Grounding

(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
- Process Water Systems
  - Demin tank
  - Raw Water System Storage Tank and Piping
  - Waste Water System Piping
  - Firewater System Piping (HDPE piping Thermal Welding Inspections)
- Oily Waste System
- Lube Oil System

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

#### **A. Structural      Steel**

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

**B. Welding Inspections/Tests**

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

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

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

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 to the will change to Stainless Steel piping. All Natural Gas piping will be designed and constructed to ANSI B31.3.

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

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



**D. 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)

**E. 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.

**F. Raw Water System**

The Raw Water System consists of Carbon Steel Piping.

Raw Water System piping welds will be visually inspected.

**G. 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.

**H. 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
Tanks	API 650

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 time 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. A cable failing a Hi-Pot test will be tagged, segregated and removed from the job site.

**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 project. The original copies of all inspection and test reports shall be forwarded periodically to the Quality Assurance Manager for review and safekeeping. Quality related problems that cannot be readily corrected at the project site will be immediately referred to the Quality Assurance Manager for resolution.

**Section 10.0 Exceptions and Clarifications**

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

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

- Real estate property on which the Power Project is to be sited.
- Local, state, and/or government taxes associated with the Owner's corporations.
- Local, state, and/or government taxes associated with the Contractor furnished equipment.
- Any site environmental cleanup or modifications to site. Contractor shall clean the area after construction.
- 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 for two years of operation.)
- Engineering, Design or Construction per specifications and requirements different than those submitted and verbally agreed to for the 2 x LM 6000 GTG's on this same site.
- Scope of Work including the GSU 230KV connection to Owner's 230KV substation.

**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 site 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.
- Owner accepts the use of Contractors proposed Codes, Standards and Specifications for this project.

**10.3 Contractor's Key Issues in Owner's Specifications Referenced include:**

- **Natural gas tightly limited relief to atmosphere (Because of No odorizing) – *joint discussions are required to resolve.***
- **Any deviation from COVENIN Standards will be subject to EDC's approval first.**

- COVENIN 1294 Hydrants
- COVENIN 200 “National Electric Code”
- COVENIN 758 “Manual Alarm Stations”
- COVENIN 823 “instructive guide on detection systems, alarm and fire fighting”
- COVENIN 1041 Central Board of detection and fire alarm”
- COVENIN 1176 “detectors. General”
- COVENIN 1329 fire protection systems. Symbols”
- COVENIN 1377 “automatic fire detection. Components”
- COVENIN 1382 “hot spot detector”
- COVENIN 1420 “optical smoke detector (photoelectric)
- COVENIN 1443 “ionization smoke detectors”
- Codes, Standards, and publications
- Venezuela Commission for Industrial Standards (COVENIN)
- **Basic Engineering**
  - Logic and functional diagrams
  - Drawings of architectural details – *Not included in our standard “fast track” project.*
  - Plans for details of security systems, fire detection
  - Currently operating philosophy of the plant is simple cycle
  - Plan workshop
  - EDC reserves right to approve development of all basic and detailed engineering, and acquisition of all the teams that make up this range, including any other equipment that may compromise the efficiency and reliability of the plant. - *Design uses available “off the shelf” equipment to meet schedule*
- **RULES OF THE EDC** – Contractor will use the same rules and procedures as are currently being used on the first phase of the LaRaisia.
- **Operations rules** – Contractor will use the same rules and procedures as are currently being used on the first phase of the LaRaisia.
- **Standards of Materials** – *Design basis is USA and World Standards*
- **Other Rules** – Contractor will use the same rules and procedures as are currently being used on the first phase of the LaRaisia.

#### 10.4 Additional Scope

The following Spreadsheet defines the additional Scope which has been requested by Owner agreed to by contractor.



EDC/Asincro					
Nro.	Section	Name of section	Technical Scope Document Derwick	EDC/Asincro comment	Answer Pro Energy-Derwick xx-xx-10
See Technical Scope Document for LM 6000 La Raisia Power Plant by Derwick with EDC/Asincro comments					
1	1,0	Introducción	Turnkey proposal	Fast-track, with three steps of approval made by the owner or the owner's representative. (7.1.5.)	Sect. 7.1.5 relates to the 30/60/90 design review. Since this approach didn't work on La Raisia I, we have developed a new approach for La Raisia II which is described in the attached document.
2	1,0	Introducción	Commissioning of PD	Contractor shall comply with the schedule of the project	PD commissioning is much more complex and is totally dependent on how long it takes to "Map" the control system. We cannot commit to a definite schedule for the PD.
3	2.0	Scope of Work and Equipment	GE LM 6000 Generator	gas turbine generator package	We don't understand this comment.
4	2.0	Scope of Work and Equipment	Do not include MCC	installation of mcc, modular control rooms and exhaust stacks shall be included	The MCCs, Exh Stk, Control Rm included in a prefab metal building with HVAC
5	2.0	Scope of Work and Equipment	Fuel gas liquid	Liquid fuel does not apply	No liquid fuel
6	2.0	Scope of Work and Equipment	Optional inlet air chilling	Option with chiller is recommended	Chiller is now included in our scope of supply
7	2.0	Scope of Work and Equipment	Connection to stack	It is scope of both PC and PD?	Yes
7-A	2.0	Balance of plant	Contractor will procure oil	Oil will be supplied by owner	OK
8	2.0	Balance of plant	Mechanical installation	Demin water, waste oil, drainage, etc	Included
9	2.0	Balance of plant	Mechanical installation	Liquid fuel does not apply	No liquid fuel
10	2.0	Balance of plant	DCS PLC	Shall be DCS for all turbines and BOP	Yes
11	2.0	Balance of plant	Control System	and Protection	Yes
12	2,1,2	Plant Fuel Gas System	Inreconnect to PDVSA gas metering	header near	At header adjacent ot compressors
13	2,1,2	Plant Fuel Gas System	Compressor supply pressure	675 - 681 psig for the PC and PD respectively.	700 psig with regulators
14	2,1,3	2.1.3 Liquid fuel system	Liquid fuel system	Liquid fuel does not apply	No liquid fuel
15	2,1,4	Water and Demi System	Demin System	Demin water modules shall be similar to existing demin modules of P&W FT8	Expansion of existing demin treatment system
16	2,1,4	Water and Demi System	Demin water pumps	Add spare pump of 50% capacity for 3x50%	Two 100% pumps are in our price - Additional cost to go with 3-50% pump arrangement
17	2,1,4	Water and Demi System	Demin filters	Filters shall be duplex type	Yes
18	2,1,4	Water and Demi System	Demin piping	Shall be stainless steel	Yes
19	2,1,4	Water and Demi System	Demin system	Add 3x50% raw water pumps	Two 100% pumps - Additional cost to go with 3-50% pump arrangments
20	2,1,4	Water and Demi System	Demin system	Add 275.000 demin tank	
21	2,1,5	Oily Water Drain System	Drain system	and gas turbine generator drains	Yes
22	2,1,6	Plant Fire water System	Fire water system	Design shall be according to PDVSA standars	Quoted to same standards as the existing LaRaisia I system
23	2,1,6	Plant Fire water System	Fire water system	Water Spray Systems for transformers	Same as above
24	2,1,7	Instrument and Service Air System	dryer	Add filters	Comes with dryer and filters
25	2,1,7	Instrument and Service Air System	compressors	piping can be routed from existing service compressors to LM 6000 area and save compressors installation	We need one air compressor for pair of LM 6000s
26	2,2,1	13,8 kV System	fused disconnects	Shall be circuit breakers	Agree
27	2,2,2	13,8/4,16 kV System	Auxiliary power transformer	It should be noted that 1X 13,8/4160 KV Aux. Trf shall be supplied plus one spare. Total 2	This is now included in our scope of supply.
28	2,2,2	13,8/4,16 kV System	three (3) MCCs	one (1) MCC	One 4.16KV starter per compressor
29	2,2,5	Plant area Lighting	metal halide floodlights	High Pressure Sodium	OK
30	2,2,6	Ground grid	ground grid expansion	According to IEEE 665	This will be designed and installed to the same standard as that on La Raisia I.
31	2,2,7	Plant Electrical cable tray	on pipe racks	Shall be cable trench	Same as La Raisia I



32	2,2,9	Lightning protection	Exhaust stacks	Not only the stacks, but the buildings, structures, etc within the project area that need to be protected against the Lightning discharge.	Agreed
33	2,2,10	Batteries/Chargers/PC System	DCS PLC	Shall be DCS for all turbines and BOP	The existing DCS will be expanded to include these additional units.
34	2,3,1	BOP Control system	DCS PLC	Shall be DCS for all turbines and BOP	Ditto
35	2,3,1	BOP Control system	HMI's to interface	We understand there will be a remote panel to control the two (2) LM 6000 as well.	Ditto
36	2,3,1	BOP Control system	DCS expansion	include	Ditto
37	2,3,1	BOP Control system	DCS System	but the new system shall be a state of the art	Ditto
38	2,3,1	BOP Control system	DCS System	The new DCS shall include all the new configuration for the existing three(3) P & W turbines and the two (2) GE 7EA turbines in La Raisa Plant	Ditto
39	2,4,1	GSU's	GSU's	Contractor scope stops at high voltage side of the transformer (high voltage 230 kV bushing). Contractor shall install the transformers and accesories	Our scope ends at the Low Side bushings of the GSU's which is the same as on LaRaisa I. We will set and assemble the transformers.
40	2,4,2	Protective Relaying	relay	Protective relay panel	This in now included in our scope of supply.
41	2,4,3	Site Work	Compressors foundations	Contractor will supply foundations for three (3) compressors, installing two at this moment	Areed
42	2.6	Plant Civil and structural	Concrete foundations designed to IBC	GTG and all Concrete foundations shall be designed as per COVENIN Standards for Industrial Buildings and Seismic Foundations,, 1756, etc.	These will be designed and constructed according to the same standards as those on La Raisa I.
43	2.7	Plant Buildings	Gas Compressor shed expansion	please clarify	Yes
44	2.12	Spares	Provison to supply	Contractor shall supply all consumables and spare parts during start up and commissioning and a list of spare parts for two years operation for turbines and BOP equipment	This is now included in our scope of supply.
45	2.14	Engineering and Project management	Detailed engineering	Contractor provide engineering (drawings and documents) for aprobation of Asincro/EDC	Yes
46	2.14	Engineering and Project management	Provide project management	Safety and Health Supervisors, as required by Local Ordinances, Inpsasel, etc.	Yes same as was done on La Raisa I
47	2.14	Engineering and Project management	Chiller	Is this chiller for the inlet air?	The chiller is for the gas turbine inlet.
48	2.14	Engineering and Project management	Contractor to provide	Contractor to provide O&M service for at least 6 months after C/O	This now included in our scope.
49	2.14	Engineering and Project management	electronic and hard copies	One set was included in turbines supply	Yes this is included.
50	2.15	Cathodic Protection	underground piping	and tanks	Yes
51	3.0	Balance of Plant	Coonection of gas	Connection will be in a header tie in.	Yes
52	3.0	Balance of Plant	Erction of 2 exhaust stacks	Supplied by contractor?	Yes
53	3.0	Balance of Plant	gas compression shed expansion	Of which shed ?	Yes
54	3.0	Balance of Plant	Buildings	Add fire Water Pumping Station Shed Expansion	This is not required since there will not be an additional fire water pump/system installed.
55	3.0	Balance of Plant	ESD valve	Please eliminate this valve	
56	3.0	Balance of Plant	100% fuel gas compressors	One for each turbine (1 x 1)	Agreed - 2x 100% with no backup.
57	3.0	Balance of Plant	Water tank, pumps	According to comments in 2.1.4	Yes
58	3.0	Balance of Plant	1 3,8 kV/4160 V fuel gas compressors	They should be two (2)	Agreed
59	3.0	Balance of Plant	Area Lighting	EI Area Lighting debe ser 50 Lux.	Agreed
60	3.0	Balance of Plant	Instr. And control	DCS no PLC	It is a PLC based DCS
61	4.1	Design Conditions	Tanks	Add new demin water tank of 275,000 Gal	The size of the existing demin water tank was originally designed according to EDC's specifications to supply not only La Raisa I but also the expansion. An additional tank will require a major cost increase.

62	4.2	Interconnect points	Fuel gas	header near EMR	We don't understand this comment.
63	5.0	Expected performance	with chiller	This option is recommended. Difference is 7 MW	The chiller is now included in our scope.
64	7,1,7	Construction Phase on site	training	Is advisable to include an extended O&M support after start up and during the period of 6 months of initial commercial operation.	This is now included in our scope of supply.
65	8.0	Project Schedule	Schedule	Please supply schedule and list of products in each phase	This will be done upon kick off of the project.
66	9.0	Project QA/QC Plan	Turnkey proposal	Fast-track, with three steps of approval made by the owner or the owner's representative. (7.1.5.)	Same as Item 4
67	9.0	Project QA/QC Plan	Equipment and material specification	Equipment and material specification shall be provided to the client or client's representative for revision	This will be done according to the same procedure as was followed on La Raisa I
68	9.0	Project QA/QC Plan	Purchase Order	Vendor's bids shall be revised by the owner or owner's representative before purchase	Same as above
69	9.0	Project QA/QC Plan	Field purchase order	Vendor's bids shall be revised by the owner or owner's representative before purchase	Same as above
70	9.0	Project QA/QC Plan	Site Preparation	Grain, density, Humidity analysis of soil material shall be done before earth moving. Compaction analysis during the bacfill shall be done for each compacted layer of 25 to 30 cms thickness.	The site has already be been backfilled and compacted on La Raisa I. We will do density test after excavation of the main foundations on La Raisa II.
71	9.0	Project QA/QC Plan	Concrete foundations	Soil study, including at least 3 borings in the centerline of emajor equipment foundation, like the turbine generator shall be done in order the structural engineer may recommend the subsoil improvement or preparation.	We will do this.
72	9.0	Project QA/QC Plan	Concrete foundations	1.The selection of appropriate cement for concrete. 2. Determine the level of acceptance of allowed slump and temperature for each concret mixing truck. 3. Carry on the required concrete strenght test at 7, 14 and 28 days of poured. 4. Carry out a conservative procedure of curing the concrete after poured, by adding appropriate aditives to avoid concrete superficial cracks, like ANTISOL from SIKA, and to maintain a permanent wetting of concrete surface.	We will follow the same specifications as La Raisa I.
73	9.0	Project QA/QC Plan	Electrical	Confirm adequate insulation of cable terminals, etc. To use thermo contractile sleeves for the cable terminations.	Will Comply
74	9.0	Project QA/QC Plan	Structural Steel	For all the structural steel it will be required the certificates of origin, certificate of mill batch, for each dia. of steel rebar, etc.	We will do the same as we did on La Raisa I.
75	9.0	Project QA/QC Plan	Part II Tets	Painting tests shall be included	This is now included in our scope of supply.
76	9.0	Project QA/QC Plan	Part II Standards and codes	PDVSA standars apply for fire system. Please include	Quoted to same standards as LaRaisa I
77	9.0	Project QA/QC Plan	Part II Standards and codes	API 650 for tanks	Yes
78	9.0	Project QA/QC Plan	Part II Standards and codes	IEEE Std. 665 - Standars for Generating Station Grounding	We will use the same standards as La Raisa I.
79	9.0	Project QA/QC Plan	Tests for liquid fuel system	It does not apply	No liquid fuel
80	9.0	Project QA/QC Plan	Tests	add demin tank	Same as Comment on Line 65,
81	9.0	Project QA/QC Plan	Welder Qualifications	API 650 for tanks	Agreed
82	9.0	Project QA/QC Plan	Cable insulation testing	A cable failing a Hi-Pot Test will be tagged, segregated and removed from the job site.	Agreed
83	10.0	Exceptions and clarification	Any site environmental cleanup	Please clarify. Contractor shall clean area after construction	We will clean up any waste or trash generated by Derwick during construction.

84	10.0	Exceptions and clarification	Operating spares	Contractor will supply a list of recommended spare parts for two years of operation	We will provide a separate proposal to cover this.
85	10.0	Exceptions and clarification	3 FT8 GTG's	2 LM 6000	Agreed
86	10.0	Exceptions and clarification	COVENIN specs.	COVENIN standars are strictly required in República Bolivariana de Venezuela. Specific cases will be studied by the owner or owner's representative, and any deviation from this standars will be made after EDC's approval	We will design and build to the same standards that we used on La Raisa I.
87	10.0	Exceptions and clarification	Right to approve	EDC ractifies that reserves this right	We don't understand this comment.
88	10.0	Exceptions and clarification	Rules of the EDC	Design shall be made according to EDC's internal standars, including those of design and operation	We will design and build to the same standards that we used on La Raisa I.
89	11.0	Drawings	Overview General Arrangement Plot Plan	Please update according to plot plan TER-01-0102-PLA-C-0072 REV 1	We will update this once EDC provides it to us.
90	11.0	Drawings	Overview General Arrangement Plot Plan	Derwick's scope shall include 13,8 kV connection from the generatos to the GSU transformers	Agreed
91	11.0	Drawings	General Arrangement Plot Plan 1 (turbine arrangement)	It is not accordance to Derwick drawing 0923-10-001 hoja 1 Rev 0	The drawings in the TSD were preliminary. All drawings will be updated prior to the first drawing submittal.
92	11.0	Drawings	General Arrangement Plot Plan 1	Please update according to plot plan TER-01-0102-PLA-C-0072 REV 1	Same as above
93	11.0	Drawings	General Arrangement Plot Plan 1	Liquid fuel does not apply	Same as above
94	11.0	Drawings	General Arrangement Plot Plan 2	New meter skid does not apply	Same as above
95	11.0	Drawings	General Arrangement Plot Plan 2	Please update according to plot plan TER-01-0102-PLA-C-0072 REV 1	Same as above
96	11.0	Drawings	General Arrangement Plot Plan 3	Add equipment mentioned in 2.1.4	Same as above
97	11.0	Drawings	General Arrangement Plot Plan 3	Please update according to plot plan TER-01-0102-PLA-C-0072 REV 1	Same as above
98	11.0	Drawings	Process flow diagram 2	Fuel gas metering station does not apply	Same as above
99	11.0	Drawings	Process flow diagram 2	Add 3x50% raw water pumps	This is now included in our scope of supply.
100	11.0	Drawings	Process flow diagram 2	Add new demin water tank of 275,000 Gal	This is now included in our scope of supply.
101	11.0	Drawings	Process flow diagram 2	Change to 3x50% demin forwarding pumps	Only if EDC elects to pay the additional cost to supply
102	11.0	Drawings	One line diagram 1	Verify with manufacturers if it is possible to make this connection from SWGR-400 y SWGR-500	Will Comply
103	11.0	Drawings	One line diagram 1	CT's connections. This installation shall be made by Derwick	This is now included in our scope of supply.
104	11.0	Drawings	One line diagram 1	Is preferable to make the connection this way	We don't understand this comment.
105	11.0	Drawings	One line diagram 1	Two 13.8/4.16 kv transformers connected to a 4,16 kV switchgear are required to feed gas compressor	This is now included in our scope of supply.
106	11.0	Drawings	One line diagram 1	Breakers are required	Agreed
107	11.0	Drawings	One line diagram 1	Synchronization shall be possible at 13.8 kV and at 230 kV. Synchronizator shall be provided and installed by Derwick	This is now included in our scope of supply.
108	11.0	Drawings	One line diagram 2	Verify with manufacturers if it is possible to make this connection from SWGR-400 y SWGR-500	Will Comply
109	11.0	Drawings	One line diagram 3	Synchronization shall be possible at 13.8 kV and at 230 kV. Synchronizator shall be provided and installed by Derwick	This is now included in our scope of supply.
110					
111					
112					

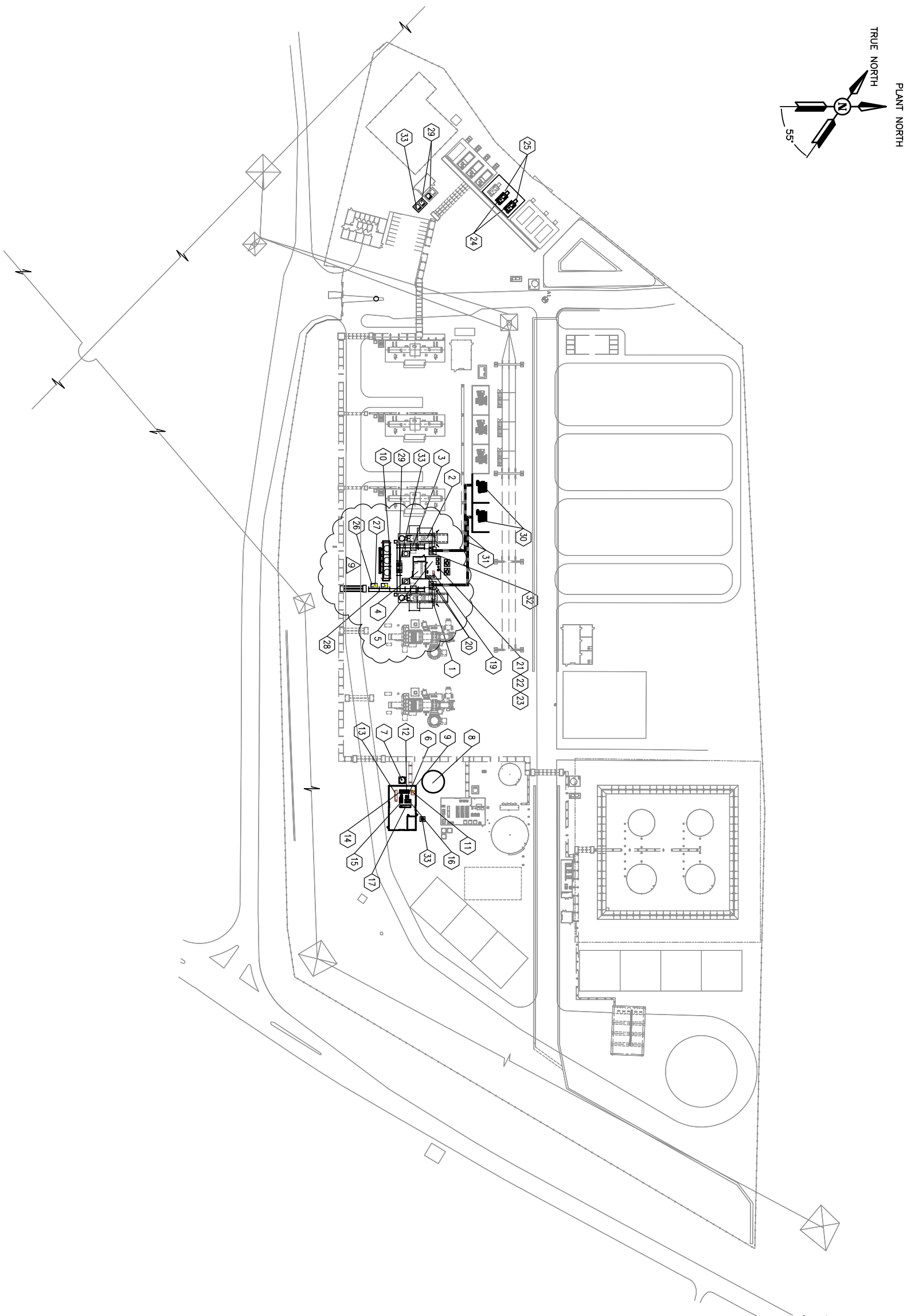
## **Section 11.0 Drawings**

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

Overview General Arrangement Plot Plan	10-001 Sh 1
General Arrangement Plot Plan	10-002 Sh 1
General Arrangement Plot Plan	10-002 Sh 2
General Arrangement Plot Plan	10-002 Sh 3
Process Flow Diagram	50-001 Sh 1
Process Flow Diagram	50-001 Sh 2
One Line Diagram	60-001 Sh 1
One Line Diagram	60-001 Sh 3
One Line Diagram	60-002 Sh 1
One Line Diagram	60-003 Sh 1
One Line Diagram	60-004 Sh 1
One Line Diagram	60-005 Sh 1

Note: All comments in red are going to be incorporated into the final drawings once the project kicks off.





## GTG EQUIPMENT

- 1 LM6000 PC GAS TURBINE GENERATOR ( GTG-500 - QTY 1 )
- 2 LM6000 PD GAS TURBINE GENERATOR ( GTG-400 - QTY 1 )
- 3 AUX SMD ( GTG-400-2 / GTG-500-2 - QTY 2 )

- UTILITY BUILDING FOR MCC & CONTROL PANELS

- 5 SHED AREA FOR LM6000 SKIDS

## WATER TREATMENT EQUIPMENT

- ⑥ DEANN FILTER SKID ( F-401A/B - QTY 1 )
- ⑦ RO TANK - 21,000 GALS ( T-401 - QTY 1 )
- ⑧ DEANN WATER TANK - 275,000 GALS ( T-400 - QTY 1 )
- ⑨ WATER TREATMENT BUILDING AND EQUIPMENT
- ⑩ CHILLER / COOLING TOWER COMBINATION UNIT ( E-300 - QTY 1 )
- ⑪ DEANN FORWARDING SKID ( P-402A/B/C - QTY 1 )
- ⑫ RAW WATER PUMP SKID ( P-450A/B/C - QTY 1 )
- ⑬ ED SKID ( M-454 - QTY 1 )
- ⑭ RO PUMP SKID ( P-401A/B - QTY 1 )
- ⑮ WATER SOFTER SKID ( M-453 QTY 1 )
- ⑯ SEDIMENT SKID ( M-450 - QTY 1 )
- ⑰ RO SKID ( M-452 - QTY 1 )

## LM6000 AUX EQUIPMENT

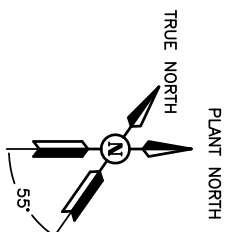
- |    |  |
|----|--|
| 18 | NOT USED                                       |
| 19 | WATER INJECTION SMD ( M-510 - QTY 1 )          |
| 20 | SPRINT SMD ( M-411 / M-511 - QTY 2 )           |
| 21 | AIR COMPRESSOR PACKAGE ( C-450A/B - QTY 2, 2 ) |
| 22 | DRIVER ( D-450 - QTY 1 )                       |
| 23 | RECEIVER TANK ( T-450 - QTY 1 )                |

## FUEL GAS EQUIPMENT

- |    |   |
|----|---|
| 24 | GAS COMPRESSOR ( C-400 / C-500 - QTY 2 )                    |
| 25 | GAS COMPRESSOR FIN FAN                                      |
| 26 | FUEL GAS REGULATOR AREA ( PCV-400A/B / PCV-500A/B - QTY 4 ) |
| 27 | FUEL GAS FILTER AREA ( F-400A/B / F-500A/B - QTY 4 )        |
| 28 | PIPE RACK   |

## ELECTRICAL EQUIPMENT

- 29 AUX TRANSFORMER 4160 V
- 30 LM6000 GSU ( GSU-400 / GSU-500 – QTY 2
- 31 OVER HEAD CABLE TRAY
- 32 15 KV BREAKERS
- 33 AUX TRANSFORMER 480 V
- 34 NOT USED



La  
Electricidad  
de Caracas



**DERWICK ASSOCIATES S.A.**

EDG International, Inc  
Certificate of Authorization No: 4913  
Renewal Date: 6/30/2012

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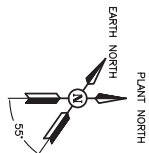
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6	7/29/10	LES		REMOVED GAS COMPRESSOR AND RIG PUMP & ADDED NO TANK	DRWN		4 5/10	
5	7/22/10	LES		ADDED MAX TRANSFORMERS, MCC BUILDING, AND CHILLED NO TANK	CHECK			
4	6/24/10	LES		REMOVED PUMP 1, BACK GROUND, REFRIGERATION, AND CHILLED NO TANK	DESIGN			
3	6/14/10	LES		REMOVED PLANT BUILDING, REPLACED WITH 2 CRYO TANK MODULES	LES		4 5/10	
2	6/14/10	LES		REMOVED PLANT BUILDING, REPLACED WITH 2 CRYO TANK MODULES	LES			
1	6/14/10	LES		REMOVED PLANT BUILDING, REPLACED WITH 2 CRYO TANK MODULES	DESIGN			
8	9/2/10	LES		REMOVED AND REPAIR, REVISED LEGEND CALCULI, & ADDED WATER TREATMENT SMOGS	POOL WAR			
7	7/31/10	LES		REVISED COOLING TOWER SIZE	TS			
NO.	DATE	BY	APP'D	DESCRIPTION	REVISIONS	SCALE	SIZE	D



**907 S DETROIT  
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<b>ProEnergy EPC Services, LLC</b>	
GENERAL ARRANGEMENT PLOT PLAN LM6000 GTG UNITS LA RAISA POWER PLANT PHASE II	
LA RAISA JOB NO.	DWG NO. SHEET NO.

JOB. NO.	DWG. NO.	SH NO.	REV
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It is not accordance  
to Denwick drawing  
0923-10-001 hoja  
1 Rev 0

Please update according to plot plan  
TER-01-0102-PLA-C-0072 REV 1

It does not apply

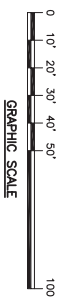
TO OWNER'S SUBSTATION

TWO (2) FRAME 7FA GTG UNITS  
LAY-DOWN AREA

LEGEND:

- 1 LM-6000 GAS TURBINE.
- 2 EXHAUST STACK.
- 3 AUXILIARY SKID.
- 4 GENERATOR REMOVAL AREA.
- 5 TURBINE REMOVAL AREA.
- 6 15 KV AMTCHGEAR.
- 7 MCC AREA (TURBINE).
- 8 PIPE PACK.
- 9 LIQUID-FUEL-FILTER.
- 10 LIQUID-FUEL-BOOSTER-SKID.
- 11 FUEL GAS FILTER SKID.
- 12 PUMP SHED.
- 13 LUBE OIL FIN FAN COOLER.
- 14 AIR DRYER AND RECEIVER TANK.
- 15 CONTROL AND AUXILIARY BUILDING.
- 16 WATER INJECTION SKID (2 REQUIRED).
- 17 SPRINT SKID (2 REQUIRED).
- 18 DEANIN FILTER SKID (2 REQUIRED).
- 19 AUXILIARY TRANSFORMER (480 V).
- 20 AIR COMPRESSOR.
- 21 BATTERY ROOM.
- 22 TOP AREA (TURBINE).

- SEE DRAWING NUMBERS 10-002 SH 2  
FOR GAS COMPRESSORS ADDED AND  
10-002 SH 3 FOR WATER TREATMENT  
BUILDING EXTENDED.

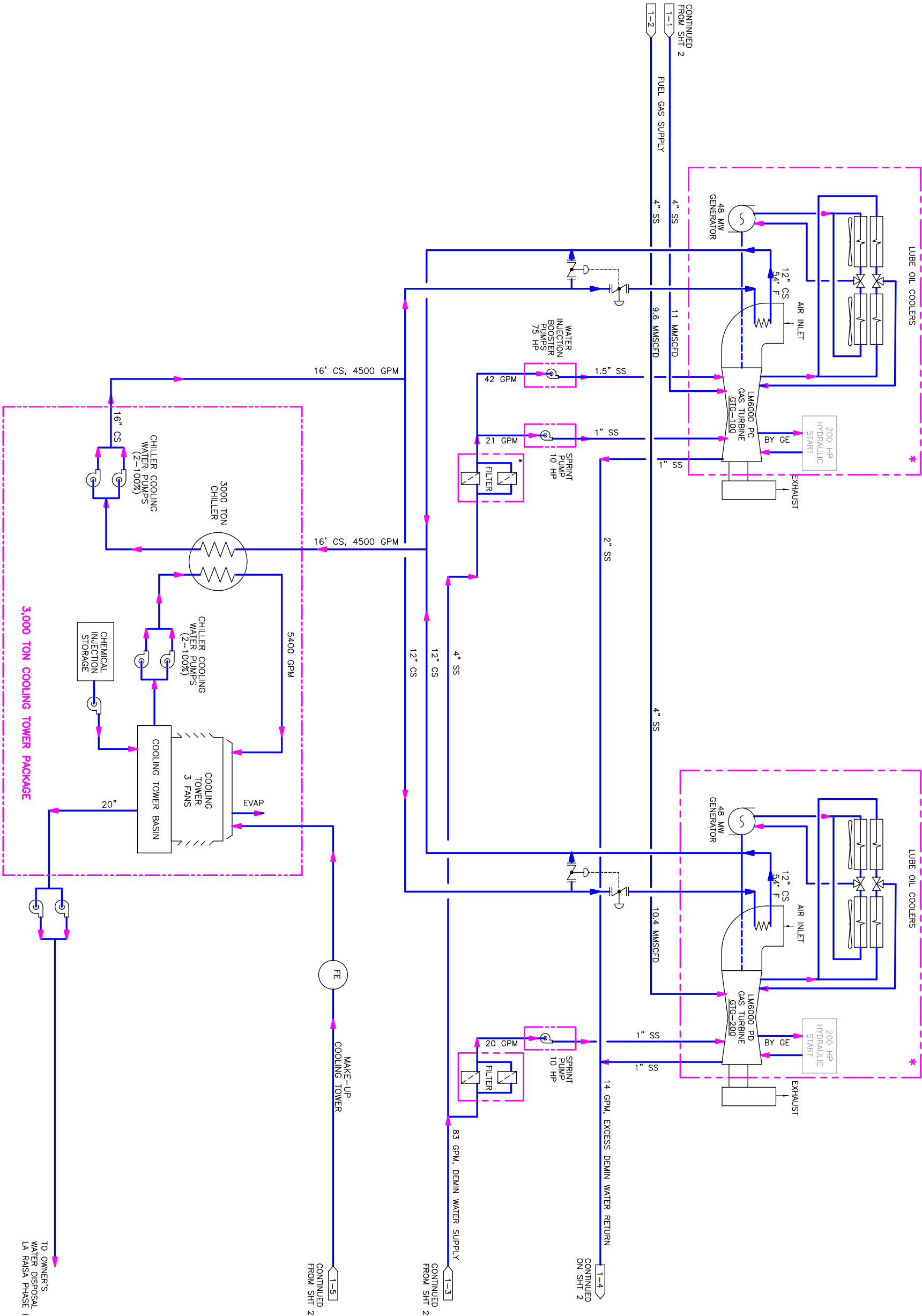


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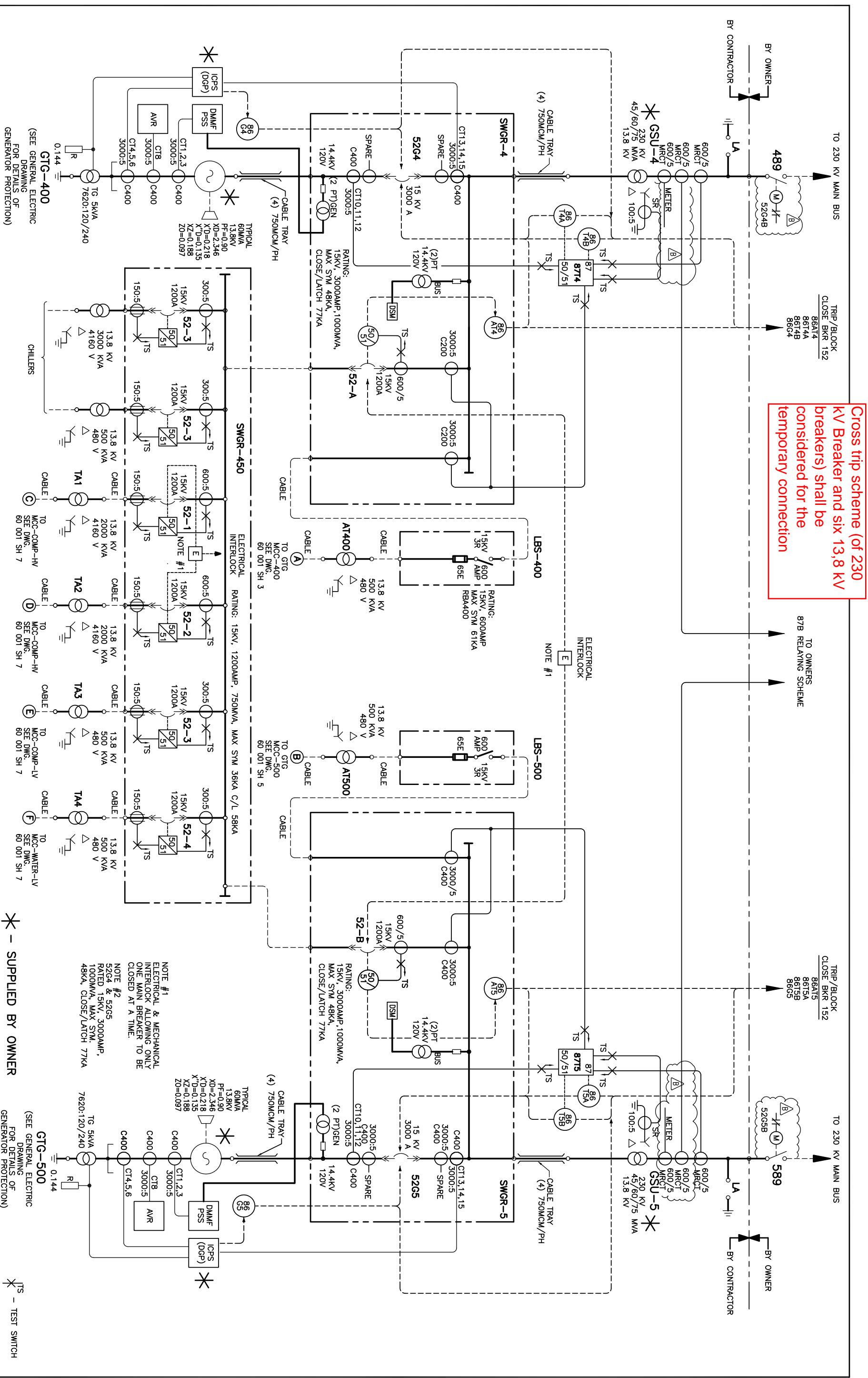


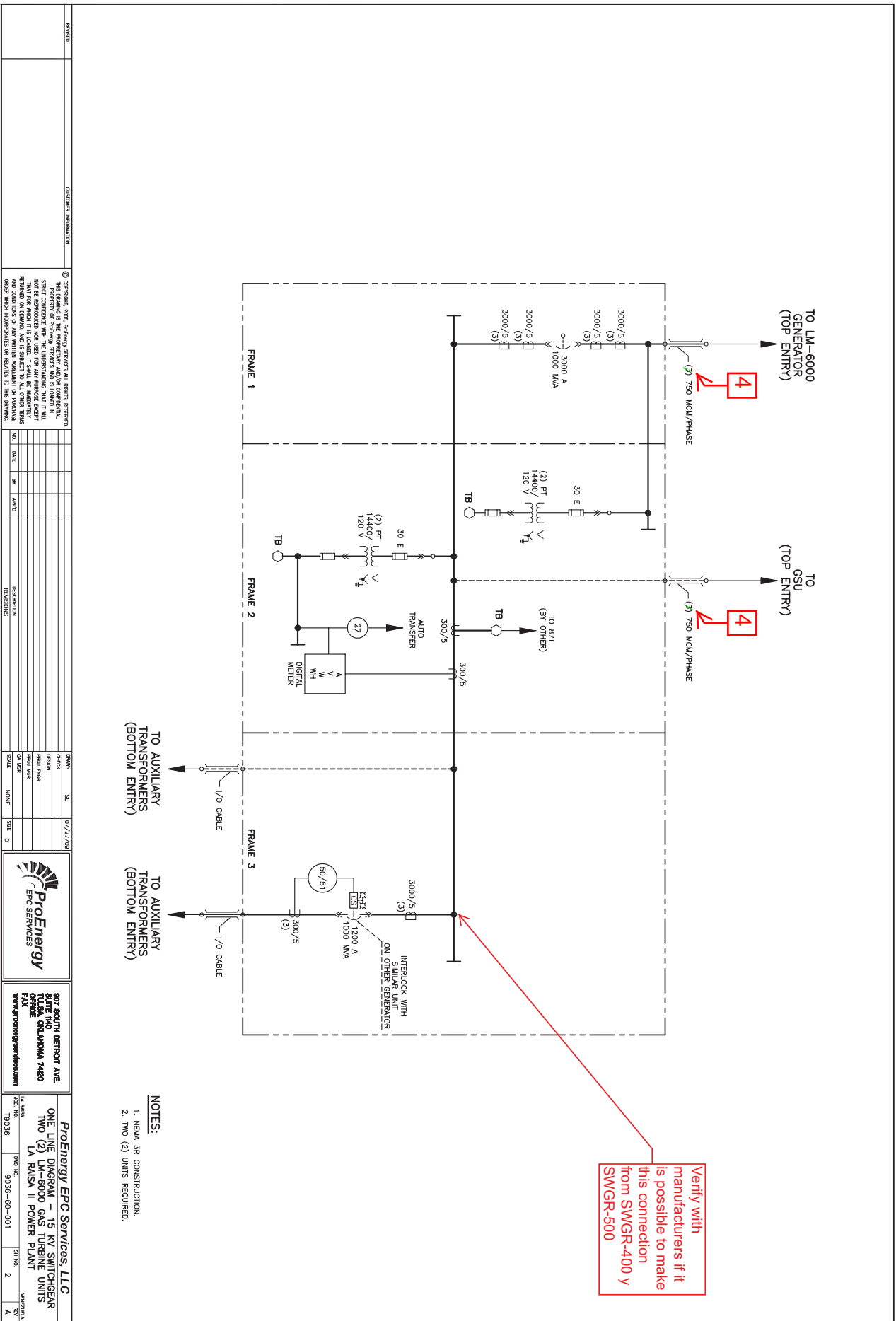


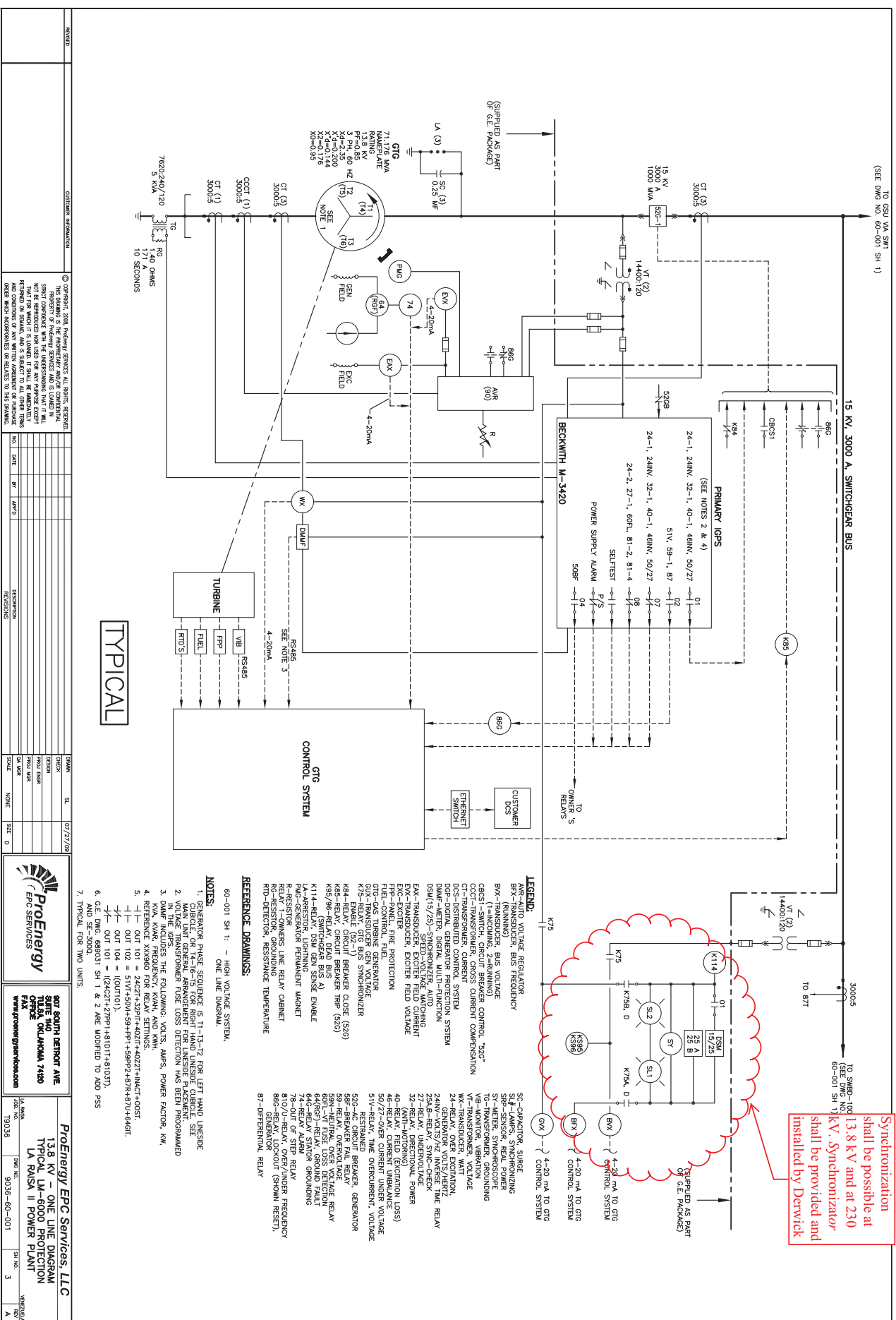


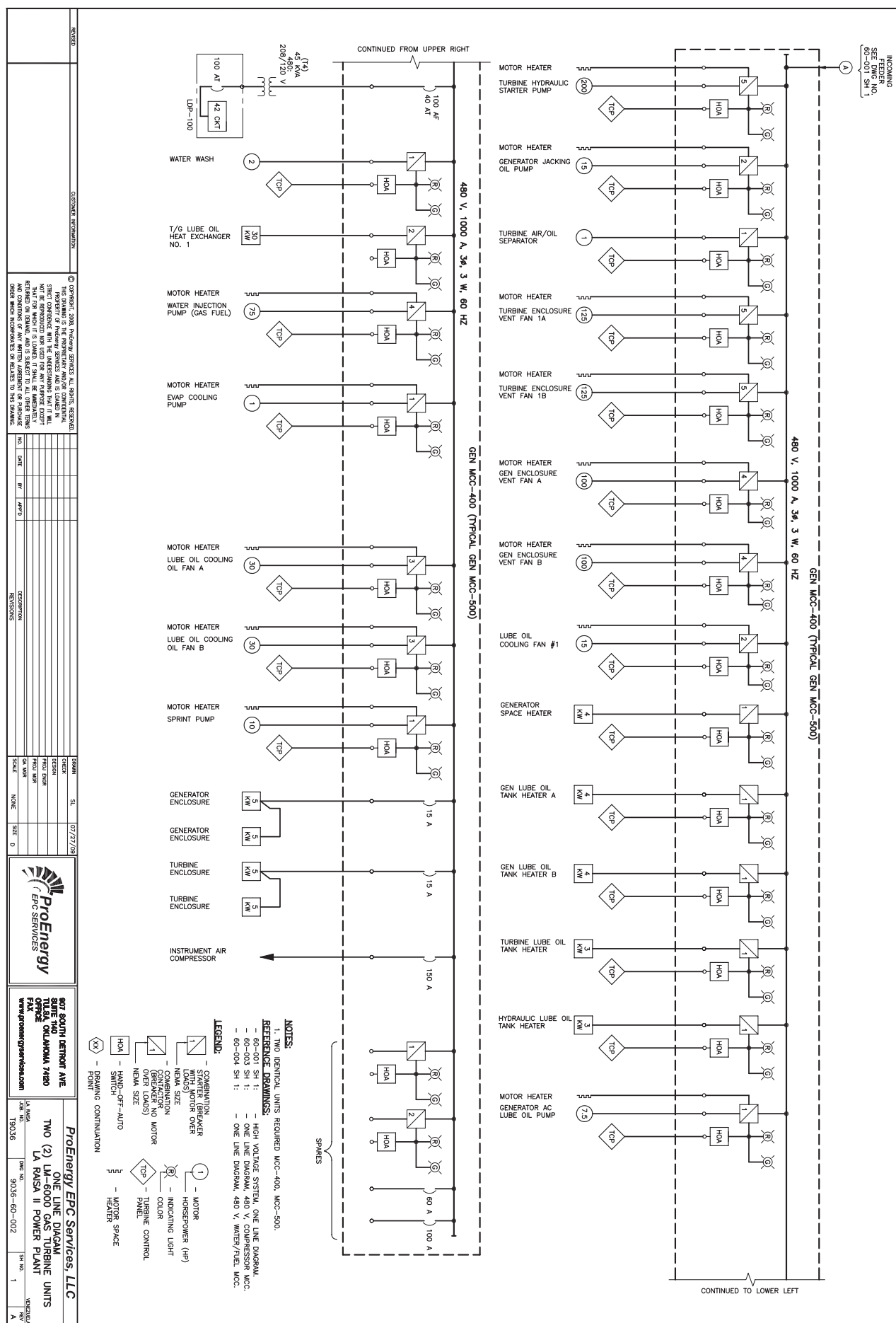
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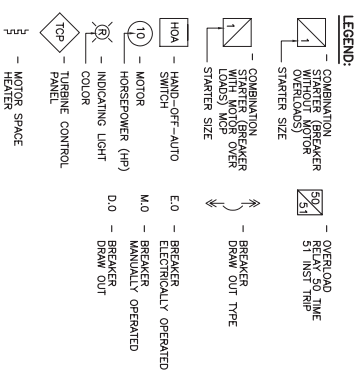
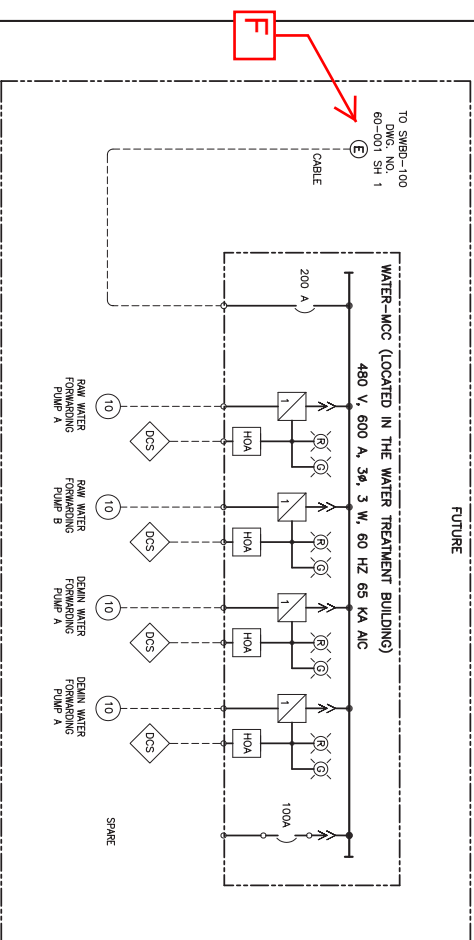
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## **12.0 Inlet Air Chiller Specifications**

Please find on the following pages the Turbine Air Systems Specifications for their Chiller Package.

## SCOPE OF SUPPLY SUMMARY

### 1.0 Major Components

Qty. 1–D-30, 60 Hz, Chiller Package with PLC Based Central Controls consisting of:

- |   |          |
|---|----------|
| • 2 x 50% Chilled Water Pumps w/ ODP, EPACT Motors (one spare ship loose).....  | Included |
| • 1 x100% Cooling Water Pump w/ ODP, EPACT Motors (one spare ship loose) .....  | Included |
| • Internal Piping, Valves, Instrumentation & Controls .....   | Included |
| • Enclosed “dry room”   |          |
| ○ Medium voltage and Low voltage switchgear   |          |
| ○ HMI screen for package control  |          |
| ○ All motor starters across-the-line  |          |
| • Refrigerant Exhaust & Space Conditioning System .....   | Included |
| • Insulated Panel Enc. on Struct. Steel Base - (90 mi/h & Seismic Zn 4 Design).....   | Included |
| • Internal Lightning and Utility receptacles .....  | Included |
| • Control valves for chilled water package isolation, turbine bypass (min. flow) and coil flow/temperature modulation ..... | Included |
| • Cooling Tower Systems, including.....   | Included |
| ○ Cooling Tower Fans (TEAO) w/ VFD motors   |          |
| ○ Cooling tower with Galvanized construction  |          |
| ○ Fan Vibration Switches - 1 per Cell   |          |
| ○ Low level switch – 1 per common basin   |          |
| ○ Condenser water piping design   |          |
| ○ Condenser large bore piping   |          |
| ○ Cooling tower support structure & design  |          |
| • Expansion Tank .....  | Included |
| • Chemical injection skid, w/ 3 pumps and chemical tote connections .....   | Included |
| • First Fill, lubricants and refrigerants.....  | Included |
| • Free-on-Board (F.O.B.) Shipping to Port of Houston .....  | Included |
| • Training, and Technical Advisory for Startup & Commissioning (5 consecutive days) .....                                   | Included |

### Scope of Supply

TAS packaged Central Chilling Plant(s), complete with the items listed in section 1.XX included in the scope of supply.

### 2.0 Standard Packaged Central Plant, consisting of following components

- 2.1 Chiller Selection – Centrifugal (primary) Trane Centrifugal Duplex Model CDHF Chiller
- 2.2 Chiller Motor Starter - Medium Voltage , remote mounted in electrical dry room
- 2.3 Chiller unit controls – Trane Adaptview, with operator interface screen, fully integrated into Central plant controls system
- 2.4 Chilled Water Pump Selection- Only Cast Iron, vertically mounted centrifugal pump(s), complete with top mounted motors, OSHA approved coupling guard, and flexible style grid coupling.
- 2.5 Condenser Water Pump selection- Only Cast Iron vertically mounted centrifugal pump(s), complete with top mounted motors, OSHA approved coupling guard, and flexible style grid coupling.
- 2.6 Cooling tower Qty One (1) cooling tower module provided per packaged plant, suitable to meet temperature load requirements
  - 2.6.1 Cooling Tower Structure - Pre-engineered and fabricated structural support for mounting Cooling Towers to mount above the Chiller Skid(s)
  - 2.6.2 Condenser Water piping loop Qty One (1) lot, large bore (>6.00” minimum NPS) cooling tower piping /header run
- 2.7 Central Plant Controls System – PLC based digital controls
- 2.8 Chemical Treatment Equipment – Located in package interior Qty one (1) Walchem controller (pH and Cond). Qty four (4) Chemical feed pumps, Blowdown Valve and Make up flow meter.
- 2.9 Expansion Tank - Chilled water loop only, to exterior of plant.

## 2.10 Standard Package Features

- 2.10.1 Structural steel members - runners, perimeter and intermediate
- 2.10.2 Lifting trunnions - Qty Four (4) retractable per plant module; ASME B30
- 2.10.3 Jack bolts - Qty one (1) per anchor bolt hole for each outside skid base member
- 2.10.4 Side panels- foam core with steel exterior and interior skins, factory-baked enamel finish.
- 2.10.5 Door -steel exterior min. of 84" high with vandal resistant locks, all keyed alike and lockable
- 2.10.6 Flooring- 3/16" (4.76 mm) minimum diamond tread plate
- 2.10.7 Roof - steel exterior and interior, sloped weatherproof and thermally insulated
- 2.10.8 Maintenance Access - removable end wall or door design for servicing, select areas
- 2.10.9 Service - Monorail beams with overhead lift device heavy lift sections for maintenance
- 2.10.10 Package HVAC Units- Bard Style HVAC units sized for total equipment heat dissipation
- 2.10.11 Thermostat- 7-day programmable, hardwired, large backlit LCD display
- 2.10.12 Refrigerant monitor Low-level leak detection
- 2.10.13 Audible and/or visual alarms – User-set Acceptable Exposure Level (AEL) of the refrigerant
- 2.10.14 Package Exhaust fan- Ventilation System, integral to alarm
- 2.10.15 Fire Extinguisher- Multi-Purpose, ABC Dry Chemical, Wall hooks included, 20 lb
- 2.10.16 Interior Lighting- Industrial T-8 lighting fixtures for main chiller and controls room
- 2.10.17 Controls dry room for Low and Medium voltage MCC/electrical equipment, operator interface via HMI control panel

## 2.11 Cooling Coils (Not provided)

- NXGN coils already in place

## 2.12 Testing & Documentation / Commissioning Services

**The following non-witnessed testing on is included with packages:**

- 2.12.1 Qty two Installation, Operating and Maintenance manuals, electronic copies, indexed PDF CD's
- 2.12.2 Chiller only standard air-run/vibration test at Trane's Facility in Lacrosse, Wisconsin
- 2.12.3 Chiller Package electrical functions check at TAS Facility in Houston, Texas
- 2.12.4 Motor control center inspection test report at TAS Facility in Houston, Texas
- 2.12.5 Centrifugal Pump only hand turn test at manufacturer's facility.

Any Testing or documentation above and beyond what is included above will be to the buyers account, no exceptions.

## 2.13 Excluded Items

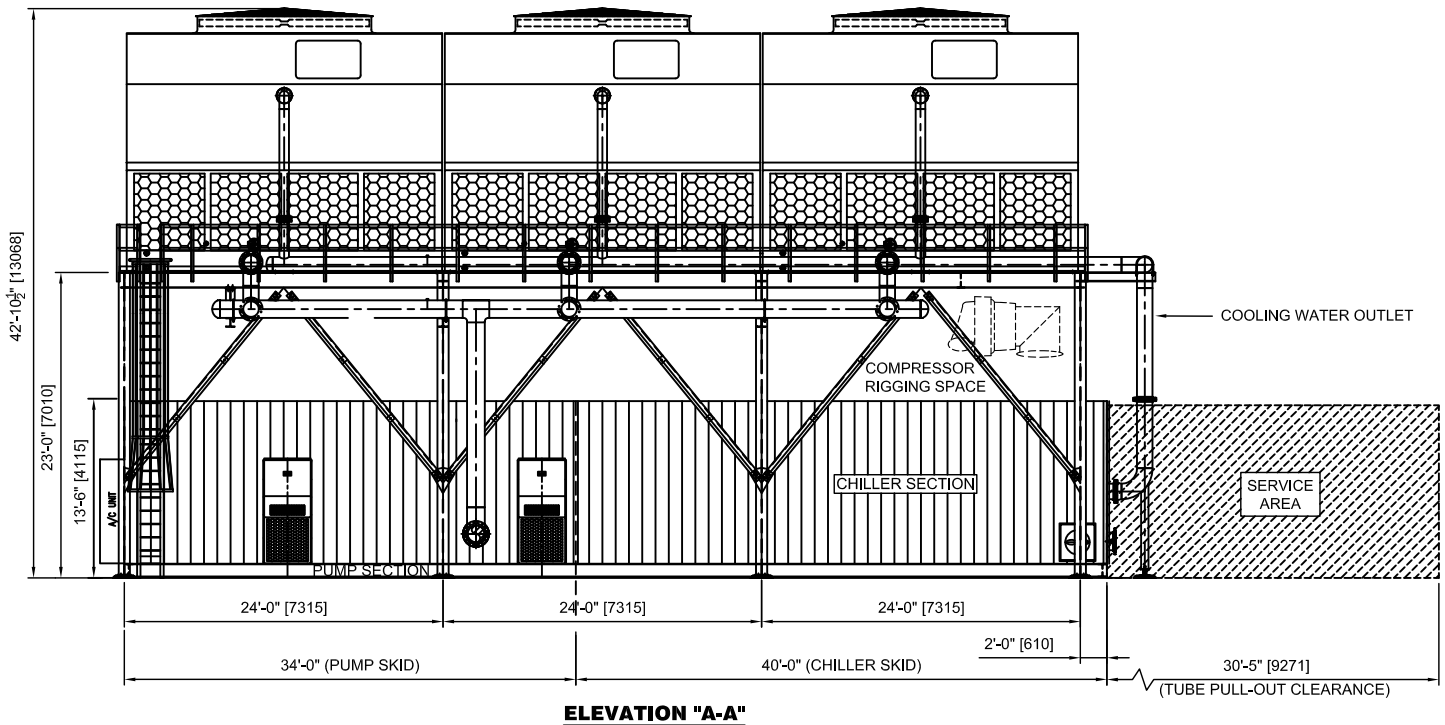
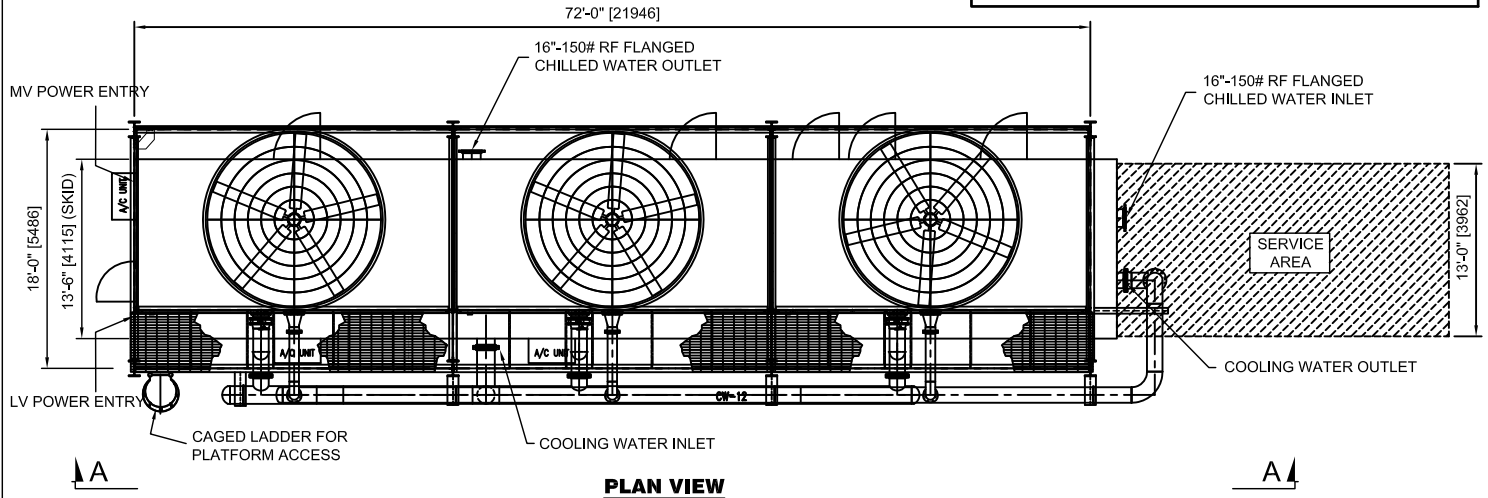
- 2.13.1 (1) 4160V and (1) 480V power feed incomer to be supplied by Owner
- 2.13.2 Chilled water piping outside the battery limits of the proposed packages.
- 2.13.3 Coil condensate handling equipment and piping
- 2.13.4 Installation of proposed scope of supply
- 2.13.5 Small bore ( $\leq 4$ " nominal O.D.) cooling tower piping.
- 2.13.6 Fill, flush, draining and disposal of flushing media
- 2.13.7 First Fill Chemical for Chemical treatment Sytsem
- 2.13.8 Evacuation of refrigerant loop (high pressure refrigerant systems only)
- 2.13.9 Freight to site
- 2.13.10 Performance or payment bonds, letters of credit
- 2.13.11 Factory & Site Performance testing
- 2.13.12 Installation supervision--To be billed at T&M per attached Rate Sheet



## Packaged Chiller Plant D-30/35

Water-Cooled Super-Duplex Centrifugal Compressor System

Nominal Cooling Capacity Range:	3,000 to 3,800 Tons (10,551 to 13,365 KW)
Nominal Chilled Water Flow Rate:	4,500 GPM (284 LPS)
Nominal Chilled Water Temp Differential:	20°F
Nominal Condenser Water Flow Rate:	5,400 GPM (341 LPS)
Voltage / Frequency:	Chiller - 4160v / 60 Hz MCC - 480v / 60 Hz



EQUIPMENT		SHIPPING WEIGHT, LB (KG.)		SHIPPING DIMENSIONS, FT. [MM]			EST. FOUNDATION WEIGHTS, LB (KG.)	
ITEM	QTY.	UNIT WT.	TOTAL WEIGHT	LENGTH	WIDTH	HEIGHT	ITEM	OPERATING WEIGHT
CHILLER SECTION	1	125,000 (57,000)	125,000 (57,000)	40'-0" [12192]	13'-6" [4113]	13'-6" [4113]	CHILLER/PUMP SKID	205,000 (93,200)
PUMP SECTION	1	55,000 (25,000)	55,000 (25,000)	34'-0" [10363]	13'-6" [4113]	13'-6" [4113]	CT, STRUCT. & PIPING	190,000 (86,400)
CT UPPER SECTION	3	13,660 (6,209)	40,980 (18,627)	24'-0" [7315]	14'-0" [4267]	11'-0" [3353]	NOTES: 1. WEIGHTS SHOWN ARE ESTIMATED ONLY. 2. THIS DWG. NOT TO BE USED FOR CONSTRUCTION. 3. DIMENSIONS SHOWN IN [ ] ARE IN MILLIMETERS.	
CT LOWER SECTION	3	7,180 (3,264)	21,540 (9,791)	24'-0" [7315]	14'-0" [4267]	8'-3" [2514]		
CT STRUCTURE	LOT	55,000 (25,000)	55,000 (25,000)	PALLETIZED AND SHIPPED IN TWO 40-FT TRAILER				
CT EXT. PIPING	LOT	13,000 (5,909)	13,000 (5,909)	PALLETIZED AND SHIPPED IN ONE 40-FT TRAILER				



## **D-30/35 Standard Features List**

### **3000 - 3800 Tons, 60 Hz, LV & MV (4160 Volts AC Max)**

- Chiller: Trane CenTraVac Model CDHF (R-123)
  - o One (1) Duplex centrifugal water chiller; direct driven, hermetically sealed
    - Two independent refrigerant circuits (compressors, motors, & switchgear)
  - o Disconnect switches and remote mounted FVNR starters
- Pumps: Paco KPV-Series (double suction, split-case, vertical in-line)
  - o Two (2) chilled water pumps (2x 100%: one pump in operation, one as stand-by)
  - o Two (2) condenser water pumps (2 x 100%: one pump in operation, one as stand-by)
  - o Manually operated isolation valves for each pump
- Cooling Tower: Evapco Model AT Series (induced-draft, counter-flow)
  - o Low water level and vibration switches
  - o Make-up valve and float assembly per cell; pipe-to-pipe & basin bypass
  - o Positioned on structure with motor service platform above the package
- Electrical: GE MCC (NEMA 1G enclosure) within adjoined dry-room
  - o FVNR starters
  - o Lugs provided for customer power supply connection
  - o One (1) MV feed for the chiller & one (1) LV feed for MCC (2 feeds total)
  - o Under floor electrical cable raceway to the pumps and chiller
- Controls
  - o Allen Bradley Control Logix PLC – sequencing, pump & tower control
  - o Allen Bradley Human-Machine Interface (HMI) for control & diagnostics
  - o External data access and control through Cat5E data switch with OPC server
  - o Standard TAS programmed sequence of operations
  - o Trane CH530 chiller control for diagnostics & data feedback
  - o Temperature, flow, pressure & valve actuator sensors provided
- Package Design
  - o 150# RF flange customer interface piping connections
  - o In-line strainers (exterior of package)
  - o Metal clad insulated wall panels attached to steel framing structure
  - o Minimum design for seismic IBC 2006 and 110 mph basic wind speeds
  - o Monorail beams over pump & chiller water boxes for maintenance
  - o Monorail on cooling tower structure for compressor removal
  - o Removable panels and doorways as required for maintenance
  - o Removable/reusable lifting trunnions
- Miscellaneous
  - o Complete drawing and documentation package
  - o Expansion tank sized to load (within package, if space available)
  - o Refrigerant monitoring and exhaust fans as required by ASHRAE
  - o Three (3) AC/heater units min.; one for dry-room, two for chiller/pumps

**13.8    Spares List****VENTILATION & COMBUSTION  
SYSTEM**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	1950-00		Switch,Differential Pressure
1	1950-10		Switch,Differential Pressure-Filter System
1	1950-5		Switch,Differential Pressure-Inlet Screen
1	2010		Gauge,Differential Pressure
5	5VX1060		Belt,Generator Supply Fan - FAN PART # C-31109 (60HZ)
6	5VX1500		Belt,Turbine Exhaust Fan - FAN PART # C-29592 (60HZ)
1	78R25N00N120E 6		Sensor,Temperature
1	XREF28	FLT93-F-1B1A203C1A03000-CSA	Flow Switch,Fan

**TURBINE LUBE OIL SYSTEM**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	J04467	3051TG3A2A21AB4C6	Transmitter,Pressure
1	132P41C6B		Switch,Pressure-Lube Oil Scavange
1	132P4S129		Switch,Pressure-Lube Oil Supply
1	152P82C6413		Switch,Differential Pressure

1	160P4S36		Switch,Differential Pressure-Lube Oil
1	160P4S43		Switch,Differential Pressure
1	162P42C6BH		Switch,Differential Pressure
1	95-117		Element,Filter-Lube Oil Tank Demister
2	AC-B244F-2440Y1		Element,Filter-VGV Pump
4	HC9600FKN13Z		Element,Filter-Lube Oil
1	J04920	XT20-1H3A-BKP	Switch,Level-Lube Oil Tank
1	155-500710-606		Heater/Thermostat-Lube Oil
1	J00464	CFSJ12002F	Valve,Thermostatic Control
1	J00092	15830-1061A	Valve,Solenoid Air Purge(H2o,Air,24VDC)

**FUEL SYSTEM**

QTY	PART NUMBER	ALT. NUMBER	DESCRIPTION
1	132P44C6B		Switch,Pressure-Fuel Gas
1	132P46C6B		Switch,Pressure-Fuel Gas
1	310-SP-1		Valve,Gas Shut Off
1	31840-1417		Valve,Solenoid-Fuel - (24VDC)
1	32861-626		Valve,Solenoid-Gas Vent
1	J01068	78R25N00A025T34E6	Sensor,Temperature-Fuel Gas
1	8915-955		Valve,Gas
1	XREF0158	PG3000-O1M-48-13-21-01-93	Transmitter,Pressure,Fuel Supply
1	J00094	DY050-NBMBA4-2N/FF1/SCT	Transmitter,Gas Fuel Flow
1	J01007	DYA-D2D-FF1/SCT	FLOW CONVERTER



1	9907-994		VALVE, LIQU FUEL
1	J00097	31830-1063E	SOV, Fuel Manifold Drain
1	L21674P13		Valve, Check
1	L21674P14		Valve, Check
1	7017M64G03		Valve, Check
1	HC8904FKS13Z		Filter, LF

**WATER INJECTION SYSTEM**

QTY	PART NUMBER	ALT. NUMBER	DESCRIPTION
1	J04460	3051TG4A2A21AB4C6	Transmitter,Flow-Water Injection
1	J00147	31861-1140A	Valve,Solenoid-Demineralized Water (DF2,H2O,120VAC)
1	8915-948		Valve,Control-Exhaust Injector
1	FT- 24C3XWRLEG-5		Transmitter,Flow-Water Injection
1	J01008	LN-5-C-MA-9	FLOW CONVERTER

**AUXILIARY SYSTEM**

QTY	PART NUMBER	ALT. NUMBER	DESCRIPTION
1	J04461	3051TA2A2A2A21AC6	Transmitter,Pressure-HP Compressor Inlet & Inlet Air
1	J03490	EJA310A-DAS-92NC/FF1/HAC/D1	Transmitter,Pressure-Inlet Static

1	XREF0212	PA3000-01M-48-13-21-01-93	Transmitter,Pressure-Turbine HP Compressor Discharge
1	XREF0160	PA3000-200-48-13-21-01-93	Transmitter,Pressure-LP Turbine Inlet
1	XREF0159	PA3000-500-48-13-21-01-93	Transmitter,Pressure-Thrust Balance

**3500 SERIES VIBRATION SYSTEM**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	3500/15-04-01		DC Power Supply
1	3500/92-04-01-01		System Monitor
1	3500/44-02-01		Aeroderivative Monitor
1	3500/40-02-01		Proximito Monitor
1	3500/42-02-01		Proximito/Seismic Monitor
1	33018/50-05		Proximito
1	33018/90-05		Proximito
1	XREF0103	86517-01-01-01-01	Accelerometer Interface Module
	607208-00		Cable
1	3500/22-01-01-01		Transient Data Interface
1	3500/25-01-05-01		Module, Keyphasor 3500
1	3500/32-01-01		Module Relay 4 Channel
1	3500/92-04-01-01		Module, Communication Gateway
1	350500-00-00-00-01-01		Dynamic Pressure Charge Amplifier
1	145536-01		Cable, Inter. Dynamic Pressure

**HYDRAULIC START SYSTEM**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	100P44C6R		Switch,Pressure-Hydraulic Pump Control
1	100TC5DC6R		Switch,Temperature-Reservoir
1	132T4FC6		Switch,Temperature
1	180P44C6R		Switch,Vacuum-Charge Pump
1	5115005		Starter Motor
1	6601-01-019-C		Overrunning Clutch
1	J04919	XT31-002B-B0A	Switch,Level-Reservoir
2	P16-5332		Element-Charge Pump
4	P16-5659		Element,Filter-Charge Pump
1	J04683	90R130KX1AB80L4F1F03GBA3610 24	Pump,Hydraulic/SOV Activated

**GENERATOR LUBE OIL SYSTEM**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	100TC5DCC6R15		Switch,Temperature-Generator/Gearbox Tank

1	J04467	3051TG3A2A21AB4C6	Transmitter,Pressure-Lube Oil Inlet
1	132P4S129		Switch,Pressure-Lube Oil
1	132P4S185		Switch,Pressure Switch-Lube Oil
1	160P4S36		Switch,Differential Pressure
1	J01068	78R25N00A025T34E6	Sensor,Temperature-Lube Oil Supply
4	HC9600FKN13Z		Element,Filter-Lube Oil
1	J04920		Switch,Level-Lube Oil Tank
1	LV471-03-05-SG1		Switch,Level-Rundown Tank
4	P16-7185		Element,Filter-Jacking Oil Pump Discharge
1	J00176	2BCSJ14002D	Valve,Control-Generator/Thermostatic

**FIRE PROTECTION SYSTEM**

QTY	PART NUMBER	ALT. NUMBER	DESCRIPTION
1	240833EXPB		Detector,Thermal Spot, 225 Deg F
1	240835EXPB		Detector,Thermal Spot, 450 Deg F
1	U7698	006962-001	Detector,Optical Flame
2	WFGASDE505		Detector,Combustible Gas

**SPRINT SYSTEM**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	132P49C6B		Switch,Pressure
1	160P4S36		Switch,Pressure
1	J04467	3051TG3A2A21AB4C6	Transmitter,Pressure
1	J03744	DY025-DBMBA1-2D/FF1/SCT	FLOW METER
1	J00092	15830-1061A	Valve,Solenoid (24VDC)
1	J00095	31840-1058A	Valve,Solenoid (24VDC)

**GE MARK VI CONTROL SYSTEM**

<b>QTY</b>	<b>PART NUMBER</b>	<b>COND.</b>	<b>DESCRIPTION</b>
	<b>FUEL CONTROL</b>		
1	IS215UCVDH2AA	NEW	CPU,MARK VI,W/GEIUS
1	IS2020DRLYH1A	R/M	TERMINATION BD. RELAY
1	IS200VAICH1C	R/M	VME ANALOG I/O
1	IS200VCRCH1B	R/M	CONTACTS IN, RELAYS OUT
1	IS200VRTDH1D	R/M	MARK VI, VME RTD CARD
1	IS200VSVOH1B	R/M	VME SERVO CARD, DRIVER
1	IS200VTCCH1C	R/M	MARK VI THERMOCOUPLE CARD
1	IS200VTURH1B	R/M	VME TURBINE CARD, SPEED
1	IS2020LVPSG1AE	NEW	POWER SUPPLY, MARK VI, 24V
1	IS210DRTDH1AA	R/M	CARD ASSEM. DRTD RAIL MTG.
1	IS210DSVOH1AA	R/M	CARD ASSEM. DSVO RAIL MTG.
1	IS210DTAIH1AA	R/M	CARD ASSEM. DTAI RAIL MTG.

1	IS210DTCIH1AA	R/M	CARD ASSEM. DTCI RAIL MTG.
1	IS210DTRTH1AA	R/M	CARD ASSEM. DTRT RAIL MTG.
1	IS210DTTCH1AA	R/M	CARD ASSEM. DTTT RAIL MTG.
1	IS210DTURH1AA	R/M	CARD ASSEM. DTUR RAIL MTG.
1	IS215VCMIH1B SEQUENCER	R/M	VME COMMUNICATIONS ASSM.
1	IC697CGR935	NEW	HOT STANDBY - CPU MODULE
1			POWER SUPPLY, 24VDC INPUT 160
	IC697PWR724	NEW	W
1	IC670ALG621	NEW	MODULE, RTD INPUT, 4 CHANNEL
1			MODULE, ANALOG INPUT, 16CH, 4-
	IC670ALG240	NEW	20MA
1			MODULE, ANALOG OUTPUT, 8CH
	IC670ALG330	NEW	4-20MA
1	IC670MDL644	NEW	MODULE, DISCRETE INPUT, 16 CH.
1	HE670RLY168	NEW	MODULE, RELAY OUTPUT, 16 CH
1			MODULE, DISCRETE OUTPUT, 16
	IC670MDL740	NEW	CH

**HOSES**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
2	398003	900003	Interconnect
2	398004	900004	Interconnect
2	398006	900006	Interconnect
1	398011	900011	GLO Hose Assembly

1	398013	900013	Instrument Line
1	398017	900017	ABC Sump Vent
1	398018	900018	DE Sump Vent
1	398019	900019	TLO Supply To Filter
1	398020	900020	TLO Supply (L1)
1	398021	900021	TLO Supply (L2R)
1	398022	900022	Header Supply (L3)
1	398024	900024	Exhaust Drain
1	398025	900025	Power Turbine Air Supply
1	398029	900029	Hydraulic Start Seal Drain
1	398037	900037	Generator Run Down Tank
1	398038	900038	Jacking Pump Supply
1	398039	900039	Jacking Pump Discharge
1	398041	900041	Jacking Oil Pump Relief
1	398084	900084	Water Injection Pump Discharge
1	398134	900134	Manifold Block To Pump Discharge
1	398045	900045	Manifold Case Drain To Filter
1	398046	900046	Pump Case Relief To Tank
1	398113	900113	Auxiliary Fan Pump To Fan Motor
1	398114	900114	Cooler To Tank
1	398049	900049	Fan Motor Discharge
1	398050	900050	Return Filter Outlet
1	398095	900095	Pump Section
1	398131	900131	Fan Motor Suction
1	398071	900071	Pump Case Drain To Filter
1	398057	900057	Filter Return To Cooler
1	398058	900058	Fan Pump Relief To Tank
1	398070	900070	Cooler By-Pass To Tank
1	398086	900086	Manifold Block To Return Filter

1	398209	900209	HOSE,3"-150# AIR/OIL SEP,ROOF
1	398210	900210	HOSE,2"-150# AIR/OIL SEP,ROOF
1	398116	900116	GLO Pump Discharge
1	398115	900115	GLO Hose Assembly
1	289195	900195	HOSE ASSY,ENH SPRT WATER CONN
1	289196	900196	HOSE ASSY,ENH SPRT NOZ AIR CON
1	288056	900056	Sprint System, Inlet Air Manifold
1	288057	900057	SPRINT SYSTEM, INTERSTAGE AND INLET WATER MANIFOLDS
1	466624	355624	Hose Assembly, Water Injection Pump

**BRUSH GENERATOR SPARES**

**(O&M Manual - Gen Type  
BDAX7.290ERJT - Manual No: 521,  
Rev: B)**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	S317741201		RECTIFIER SPARES KIT
5	S314428801		FUSE ATM20
	MAINT. SPARES		
1	S840012101		BRUSH HOLDER
	OPER.SPARES		
1	S317436007		GASKET (STATOR) SET OF 4
1	S317436002		GASKET (STATOR) SET OF 6
1	S025281528		HEATER(STATOR)
1	S314828501		TERMINAL BUSHING ASSY.



1	S314909801	GASKET(EXCITER) SET OF 4
1	S311745677	WASHER (JOINT)
1	S024116168	SEAL WASHER SET OF 4
1	S018713133	SEALING COMPOUND SET OF 3
1	S018713194	LOCKING COMPOUND
1	S314089901	PUMP OIL
1	S314263801	PUMP COUPLING
1	S313223721	HOSE
1	S314149411	SHAFT SEAL
1	S314149412	SHAFT SEAL
1	S961529800	UTILITIES CARD
1	S962243100	MICROAVR CONTROL CARD
1	S962243700	MICROAVR MONITOR CARD
1	S962615908	FUSE SEMI-COND 20A SET OF 5
1	S962615909	FUSE QUICKBLOW 5A SET OF 5
1	S962615936	FUSE QUICK BLOW 2A SET OF 5
1	S961503700	ROTOR EARTH FAULT AERIAL
1	S961502100	ROTOR EARTH FAULT XMITTER.
1	S317684302	BEARING BUSH (NON EXCITER END)
1	S317684402	BEARING BUSH (EXCITER END)

			<b>CABLES</b>
<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	608214-4036	25600-001-040-T36	E1 & E9 40' CABLE
1	608919-4036	25600-021-040-T36	E21 40' CABLE
1	608920-4036	25600-0016-040-T36	E16 40' CABLE
1	608926-4036	25600-008-040-T36	E8 40' CABLE
1	608928-4036	25600-005-040-T36	E5 & E6 40' CABLE
1	608930-4036	25600-012-040-T36	E12 40' CABLE

1	608932-4036	25600-019-040-T36	E19 40' CABLE
1	608933-4036	25600-020-040-T36	E20 40' CABLE
1	608934-4036	25600-010-040-T36	E10 & E11 30' CABLE
1	608935-3036	25600-030-030-T36	E30 & E 31 30' CABLE
1	608937-3036	25600-034-030-T36	E34 30' CABLE
1	608938-3036	25600-036-030-T36	E36 30' CABLE
1	609975-40	25600-022-040-T00	E22 40' CABLE
1	609976-40	25600-032-040-T00	E32 40' CABLE
1	8EH2ABW1	25600-0056-040-T36	E56 40' CABLE
1	8EH2DHF1	25600-043-040-T36	E54 & E55 40' CABLE

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>CABLE ADDITIONAL (PD UNIT)</b>
1	8EH15AAA1		CABLE,PATCH
1	8EH2ABW1		CABLE,BAL VALVE
1	8EH2DHA1		CABLE, ENGINE
1	8EH2DHB1		CABLE, ENGINE
1	8EH2DHC1		CABLE,ENGINE
1	8EH2DHD1		CABLE, ENGINE
1	8EH2DHF1		CABLE, ENGINE
1	8EH2DHR1		CABLE, ENGINE

**WATER WASH SYSTEM**

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT. NUMBER</b>	<b>DESCRIPTION</b>
1	J-4413		CONNTECT 6000, 55 GALLON DRUM TURBINE WASH

<b>QTY</b>	<b>PART NUMBER</b>	<b>ALT.NUMBER</b>	<b>TURBINE INSURANCE SPARES DESCRIPTION</b>
1	1304M52G03		HPT STAGE 2 BOREScope
1	1322M32G10		LPT STAGE 2/4 BOREScope
1	1642M98G01		CHECK VALVE
4	1962M86P02		T48 THERMOCOUPLE
1	1826M46G01		CHECK VALVE & TUBE
1	38-18604-2025-3		SCREEN
1	38-18604-2024-3		SCREEN
1	9299M96G07		HPT STAGE 1 BOREScope
2	9392M95P04		PLUG, IGNITER
1	9600M37P13		LEAD, IGNITER
2	L21131P02		XN25 SENSOR, SPEED
1	L24922P03		PUMP, VG HYDRAULIC
1	L31967P27		ACCELEROMETER, CRF

1	L31967P29		ACCELEROMETER, TRF
3	L35166P01		DETECTOR, RES
1	L43342P03	P04	CABLE, TEMP LIQ MANIFOLD
1	L43416P02		T3 SENSOR
1	L43418P03		VSV/ VIGV ACTUATOR
1	L43419P04		VBV ACTUATOR
1	L43420P04		VBV ACTUATOR
2	4J7316		CHIP DETECTOR
1	L44500P09		PUMP, L&S
1	L44571P01		HYDRAULIC CONTROL
1	L44684P01		LPT SPEED SENSOR
1	L44736P05		UPPER T48 HARNESS
1	L44737P04		LOWER T48 HARNESS
1	L44745P01		T2/P2 SENSOR (CIT)
1	L44745P02		T25/P25 SENSOR
1	9504M33P01		SENSOR, TEMP
6	L31476P57		FUEL NOZZLE
30	9559M20G01		GASKET,NOZZLE
2	L45970G01		TUBE, FUEL
2	L45972G01		TUBE, FUEL
2	L49274P01	L45882P04	HOSE, FUEL
2	L45881P04		HOSE, FUEL
3	L45921P01		GASKET
6	L49273P03		FUEL HOSE
1	L49274P01		SEC-FUEL HOSE
1	L47328P02		VALVE, THRUST BALANCE
1	L47330P04		VALVE, STG 8 BLEED

**TURBINE EXPENDABLE SPARES**

QTY	PART NUMBER	ALT.NUMBER	DESCRIPTION
2	1337M46P03		GASKET
2	1538M42P01		GASKET
4	1540M69P207		CLAMP
10	1704M61P03		SLEEVE

5	1704M62P04		SPACER
5	1704M62P05		SPACER
2	1704M63G07		ARM
1	1704M63G08		ARM
3	1704M63G09		ARM
1	1704M63G10		ARM
3	1704M63G11		ARM
1	1704M63G12		ARM
5	1774M59P01		SEAL
10	1855M35P08		BOLT
1	619E223P52		FITTING REDUCER
10	635E901P03		NUT SLF LKG
4	705B276P5		RING
10	9009M32P01		WASHER
4	9009M74P03		GASKET, ROUND
3	9011M60P01		GASKET
2	9013M28P01		GASKET
3	9013M29P02		GASKET
3	9013M30P02		GASKET
1	9014M45P65		CLAMP
30	9559M20G01		SEAL, RING
2	9048M33P06		BEARING
1	9057M50P01		SEAL
1	9057M92P11		GASKET, SQUARE
5	9107M23P02		GASKET
1	9107M55P01		SHIM
5	9108M27P03		BOLT
5	9109M91P01		BOLT
5	9131M44P02		BUSHING
5	9365M41P117		PACKING
5	9365M41P122		PACKING
3	9365M41P229		SEAL
3	9371M19P04	P104	SEAL
2	9371M19P06	P106	SEAL
2	9371M19P08		SEAL
2	9371M19P10		SEAL
3	9371M19P12	P112	SEAL
3	9378M31P01		FITTING

5	9379M93P01	GASKET
1	9397M20P02	BUSHING
1	9397M22P02	LOCK WASHER
10	9608M12P04	GASKET
5	9609M13P02	GUIDE
10	9609M43P02	WASHER
10	9610M50P02	NUT
3	9628M16P02	BOLT
10	9629M48P02	NUT
10	9629M48P04	NUT
10	9629M48P06	NUT
10	9629M48P10	NUT
1	9649M39P05	CLAMP
10	9699M66P01	BOLT
	AC-B244F-	
2	2440Y1	FILTER ELEMENT
10	AN316C4R	NUT
10	AN960C10	FLAT WASHER
10	AN960C10L	FLAT WASHER
10	AN960C416L	FLAT WASHER
10	AN960C516	WASHER
10	AN960C516L	WASHER
10	AN960C616L	FLAT WASHER
10	J1092P04	NUT
10	J1092P05	NUT
5	J1220G05	CLAMP
4	J1221G03	CLAMP
4	J1221G04	CLAMP
3	J1221G07	CLAMP
10	J1221G08	CLAMP
5	J1221G10	CLAMP
5	J201P04	NUT
3	J219P02	GASKET
2	J219P03	SEAL GASKET
5	J219P04	SEAL GASKET
5	J219P05	GASKET
4	J219P06	GASKET
4	J219P07	GASKET SEAL

5	J221P028	PACKING
5	J221P138	PACKING
2	J221P163	PACKING
5	J221P216	PACKING, PREFORMED
3	J221P219	PACKING
5	J221P222	PACKING, PREFORMED
2	J221P224	PACKING, PREFORMED
2	J221P240	PACKING
2	J221P260	PACKING, PREFORMED
3	J221P903	PACKING
10	J221P904	PACKING, PREFORMED
10	J221P905	PACKING
10	J221P906	PACKING
10	J221P908	PACKING
10	J221P910	PACKING
10	J221P912	PACKING
5	J221P916	PACKING, PREFORMED
10	J414P034A	BOLT
3	J415P123A	BOLT
1	L45921P01	GASKET, SEAL
2	J511P106	NIPPLE
1	J511P108	NIPPLE
1	J511P110	NIPPLE
1	J515P04	ELBOW
1	J522P57	NIPPLE
1	J534P06	TUBE NIPPLE
1	J534P08	NIPPLE
1	J534P10	TUBE NIPPLE
1	J534P12	TUBE NIPPLE
10	J574P02	NUT
2	J628P06	NUT
4	J643P04B	MACHINE BOLT
10	J643P12A	MACHINE BOLT
10	J644P06D	MACHINE BOLT
10	J644P07D	BOLT
10	J644P08D	MACHINE BOLT
5	J644P09D	BOLT
10	J644P11A	BOLT

10	J644P12A	BOLT
5	J645P30A	BOLT
1	J816P072C	BOLT
2	L28004P01	Gasket
5	L42821P01	GASKET
2	L43073P01	GASKET
1	L43616P01	BOLT
1	L44539P01	PLUG
1	L52148P01	NIPPLE
3	M83248/1-121	PACKING
3	M83248/1-243	PACKING
1	M83248/1-904	PACKING
5	M83248/1-905	PACKING
4	M83248/1-910	PACKING
5	M83248/1-912	PACKING
1	MS21083C4	NUT SLF LKG
5	MS21083C5	NUT
1	MS24693-C342	SCREW
2	MS35842-15	CLAMP
1	MS9193-04	CONNECTOR
1	MS9193-12	CONNECTOR
10	MS9201-04	NUT
3	MS9202-042	GASKET
5	MS9315-04	TUBE CAP
10	MS9321-10	WASHER FLAT
3	MS9371-15	GASKET
1	MS9404-04	PLUG
10	MS9489-07	BOLT
3	MS9556-07	BOLT
5	MS9556-10	BOLT
2	MS9557-06	BOLT
3	MS9557-07	MACHINE BOLT
5	MS9557-09	BOLT
10	MS9557-10	MACHINE BOLT
10	MS9557-14	BOLT
3	MS9557-22	MACHINE BOLT



4	MS9557-38	BOLT
3	MS9565-05	BOLT
5	MS9566-12	BOLT
3	MS9567-14	BOLT
1	MS9902-03	PLUG
2	MS9902-04	PLUG
2	MS9902-06	PLUG
1	MS9902-08	PLUG
1	MS9902-10	PLUG
1	NAS1291C8M	NUT
2	R1316P007	PACKING
2	R287P04	NIPPLE
1	R287P06	NIPPLE, TUBE
1	R287P08	NIPPLE
1	R287P10	NIPPLE
2	J644P13F	BOLT
2	J1128P12	SEAL RING, METAL
2	MS9558-24	BOLT
4	J1092P06	NUT
3	9608M08G48	GASKET
1	J1314G104	CAP ASSY
4	NAS3106C16-14	U-BOLT
4	9134M25P117	STRAP, RETAINING
38	133A1624P6	WASHER FLAT
14	MS9557-08	BOLT