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Solicitation Addendum

Addendum No.: 1
Solicitation No.: 23-TA004595SAM
Project No.: 6017982, 6017983, 6017984
Solicitation Title: Improvements at Master Lift Station 39A
Addendum Date: March 21, 2023
Procurement Contact: Sherri Meier

IFBC No. 23-TA004595SAM is amended as set forth herein. Responses to questions posed by prospective bidders are provided below. This Addendum is hereby incorporated in and made a part of IFBC No. 23-TA004595SAM.

The deadline to submit all inquiries concerning interpretation, clarification or additional information pertaining to this IFBC is March 31, 2023.

ADD:

SECTION C, BIT ATTACHMENTS, BID ATTACHMENT 2 – TECHNICAL SPECIFICATIONS, SECTION 11150 SUBMERSIBLE PUMPS

The attached Bid Attachment 2 – Technical Specifications, Section 11150 Submersible Pumps, is attached to this Addendum 1 and hereby incorporated into the IFBC.

CHANGE TO:

SOLICITATION COVER PAGE

Change to Solicitation Cover page to read:

INVITATION FOR BID CONSTRUCTION
NO. 23-TA004595SAM
IMPROVEMENTS AT
MASTER LIFT STATION 39A
PROJECT NO. 6017982,
6017983, ~~6014984~~ 6017984
MARCH 9, 2023

QUESTIONS AND RESPONSES:

Q1. What is the Engineers Estimate for this project?

R1. Engineers estimated opinion of probable cost is \$3,320,000.00.

Q2. Can you provide the sign-in sheet from the site visit?

R2. Find attached to this Addendum No. 1.

NOTE:

Deleted items will be ~~struck through~~, added or modified items will be underlined. All other terms and conditions remain as stated in the IFBC.

INSTRUCTIONS:

Receipt of this Addendum must be acknowledged as instructed in the solicitation document. Failure to acknowledge receipt of this Addendum may result in the response being deemed non-responsive.

END OF ADDENDUM

AUTHORIZED FOR RELEASE

SECTION 11150 SUBMERSIBLE PUMPS

PART 1 - GENERAL

1-1. SCOPE. This section covers furnishing pedestal-mounted, single-stage, submersible, non-clog, end suction centrifugal pumping units and controls as indicated herein or on the Drawings.

Pump application.	Raw sewage
Number of pumps.	3
Pump tag numbers.	PCL-101/102/103
Pump location.	Dry-pit

Each pumping unit shall be complete with a close-coupled, submersible electric motor, adjustable frequency drive and all other appurtenances specified, or otherwise required for proper operation.

Each pumping unit, including motor and all integral controls, shall be rated and labelled for use in a Class 1, Division 2, Group D area as defined by the National Electric Code.

1-2. GENERAL. Equipment furnished under this section shall be fabricated and assembled in full conformity with Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless exceptions are noted by Engineer. Hydraulic considerations and definition of terms shall be as set forth in the Hydraulic Institute Standards.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Seismic Design Requirements. Seismic design requirement for products specified herein shall be as indicated in the Meteorological and Seismic Design Criteria section.

1-2.03. Tagging. Each item of equipment and each part shipped separately shall be tagged and identified with indelible markings for the intended service. Tag numbers shall be clearly marked on all shipping labels and on the outside of all containers.

1-2.04. Power Supply. Unless otherwise indicated, power supply to the equipment shall be 480 volts, 60 Hz, 3 phase.

1-2.05. Identification. Pumps shall be identified in accordance with the Equipment and Valve Identification section.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. Complete fabrication and assembly drawings, together with detailed specifications and data covering materials, parts, devices, and accessories forming a part of the equipment furnished, shall be submitted in accordance with the Construction Schedule & Project Restraints section. The data and specifications for each unit shall include, but shall not be limited to, the following:

Pumps

- Name of manufacturer.
- Type and model.
- Tag number.
- Pump designation.
- Pump location.
- Rotative speed.
- Size of suction nozzle.
- Size of discharge nozzle.
- Net weight of pump and motor only.
- Net weight with pedestal, when specified.
- Complete performance curves showing capacity versus head, NPSH required, pump efficiency, wire-to-water efficiency, and pump input power.
- Data on shop painting.

Motors

- Name of manufacturer.
- Type and model.
- Type of bearings and method of lubrication.
- Rated size of motor, hp, and service factor.
- Insulation class and temperature rise.
- Full load rotative speed.
- Efficiency at full load and rated pump condition.
- Full load current.
- Locked rotor current.

Adjustable Frequency Drives

As specified in the Adjustable Frequency Drives section.

Moisture Detection System

- Name of manufacturer.
- Type and model.

Enclosure rating and layout if an enclosure is specified.
Electrical schematics and wiring diagram.
Published descriptive data on each item of equipment and all accessories, indicating all specific characteristics and options.

Control Components

Type and manufacturer.
Model.
Enclosure rating.
Published descriptive data on all components, indicating all specific characteristics and options.
Where liquid level sensors are provided, provide mounting details.

Seismic Design Requirements

Confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section.

1-3.02. Operation and Maintenance Data and Manuals. Operation and maintenance manuals shall be submitted in accordance with the Submittals Procedures section. The operation and maintenance manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

1-4. QUALITY ASSURANCE.

1-4.01. Balance. All rotating parts shall be accurately machined and shall be in as nearly perfect rotational balance as practicable. Excessive vibration shall be sufficient cause for rejection of the equipment. The mass of the unit and its distribution shall be such that resonance at normal operating speeds is avoided. In any case, the unfiltered vibration velocity, as measured at any point on the machine including top of motor, shall not exceed the maximum velocity as indicated in Figure 11.6.9.4 of the governing standard.

At any operating speed, the ratio of rotative speed to the critical speed of a unit or its components shall be less than 0.8 or more than 1.3.

1-5. SPARE PARTS. Spare parts shall be provided as follows:

<u>Spare Parts</u>	<u>Quantity</u>
Mechanical seals	1
Casing wearing plates (semi-open impeller only)	1
Sets of motor bearings	1

Spare parts shall be suitably packaged with labels indicating the contents of each package. Spare parts shall be delivered to Owner as directed.

PART 2 - PRODUCTS

2-1. SERVICE CONDITIONS. The pump specified herein will be used to pump raw sewage from the collection system into a forcemain to be delivered to a wastewater treatment plant.

The equipment provided under this section shall be suitable for the following service conditions:

Seismic design requirements.	See Meteorological and Seismic Design Criteria section
Maximum ambient air temperature (dry pit).	104 °F
Maximum liquid temperature.	80 °F
Maximum solids concentration, by weight.	0.1 %
Pumps start and stop against a closed valve.	No
Site elevation.	See Meteorological and Seismic Design Criteria section

All equipment furnished shall be designed to meet all specified conditions and to operate satisfactorily at the elevation indicated.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS. Pumping units shall be designed for the performance and design requirements as follows:

Pump tag numbers.	PCL-101/102/103
Rated head.	221 ft
Capacity at rated head.	1800 gpm
Operating head range for full speed continuous operation.	115 to 230 ft
Minimum shutoff head.	250 ft
Maximum nominal pump speed.	1800 rpm

Pump tag numbers.	PCL-101/102/103
Minimum head at reduced speed.	60 ft
Capacity at minimum head at reduced speed.	1000 gpm
Approximate minimum pump speed.	990 rpm
Maximum power required at pump input shaft at any point from minimum operating head to shutoff head.	240 bhp
Evaluated head	160 ft
Efficiency at evaluated head, wire to water.	69 %
Adjustable Frequency Drive losses included in the efficiency calculation	No
Pump designed for reverse rotation at rated head.	No
Minimum NSPHA at rated head.	31 ft
Maximum vibration velocity.	HIS
Minimum pump suction nozzle size (pedestal mounted).	10 in
Minimum pump discharge nozzle/elbow size.	8 in
Minimum test sphere diameter.	3 in

All specified conditions shall be at rated speed unless otherwise indicated.

The minimum hydrostatic test pressure shall be 1.5 times shutoff head plus max suction pressure.

Pump performance shall be stable and free from cavitation and noise throughout the specified operating head range at minimum suction submergences. The

design running clearance between the impeller inlet and the casing wearing ring (if provided) shall be not less than 0.01 inch [250 µm] or 1 mil per inch [25 µm per 25 mm] of casing wearing ring diameter, whichever is greater.

2-3. MATERIALS.

Stator Housing, Oil Chamber Housing, and Impeller Casing	Cast iron, ASTM A48.
Casing Wearing Ring	Martensitic stainless steel, Brinell 300+.
Impeller (if semi-open)	Hardened cast iron, ASTM A48, Brinell Hardness of 650+.
Bottom Wearing Plate	Hardened cast iron, ASTM A48 with spiral grooves, Brinell Hardness of 650+.
Shaft	Alloy steel, hard chrome plated; or martensitic stainless steel, AISI Type 416 or 420.
Mechanical Seals	2 tandem single type, oil lubricated with silicon or tungsten carbide seal rings at all points, except the upper rotating seal, which shall be carbon.
Pedestal Base	Cast iron or fabricated steel.
Epoxy Coating Primer & Finish Coat	Carboline "Carboguard 891" or Tnemec "Series N140 Pota-Pox Plus".

2-4. PUMP CONSTRUCTION.

2-4.01. Impeller Casing. The impeller casing shall have well-rounded water passages and smooth interior surfaces free from cracks, porosity, blowholes, or other irregularities. The discharge nozzle shall be flanged, with dimensions and drilling conforming to ANSI B16.1, Class 125.

2-4.02. Impeller. The impeller shall be semi-open one-piece casting with not more than two nonclog passages. The interior water passages shall have uniform sections and smooth surfaces and shall be free from cracks and porosity. The impeller shall be dynamically balanced and securely locked to the shaft by means of a key and self-locking bolt or nut.

2-4.03. Wearing Rings.

An axially adjustable wearing plate shall be provided in the casing. Axially adjustable wearing plate shall be arranged to permit adjustment of the axial running clearance between the impeller and plate. The wearing plate shall have an outward spiralling groove designed to force stringy solids outward and away from the impeller.

2-4.04. Oil Chamber Housing. The oil chamber shall contain a drain plug and a vent plug.

2-4.05. Mechanical Seals. Each pump shall be provided with two mechanical rotating shaft seals arranged in tandem and running in an oil chamber. Each interface shall be held in contact by an independent spring system designed to withstand maximum suction submergence. The seals shall require neither maintenance nor adjustment and shall be readily accessible for inspection and replacement.

Shaft seals lacking positively driven rotating members or conventional double mechanical seals which utilize a common single or double spring acting between the upper and lower units and requiring a pressure differential to offset external pressure and effect sealing, will not be acceptable. The seals shall not rely upon the pumped media for lubrication and shall not be damaged if the pumps are run unsubmerged for extended periods while pumping under load.

2-4.06. Sealing of Mating Surfaces. All mating surfaces of major components shall be machined and fitted with O-rings where watertight sealing is needed. Sealing shall be accomplished by O-ring contact on four surfaces and O-ring compression in two planes, without reliance on a specific fastener torque or tension to obtain a watertight joint. The use of elliptical O-rings, gaskets, or seals requiring a specific fastener torque value to obtain and maintain compression and watertightness will not be acceptable. The use of secondary sealing compounds, gasket cement, grease, or other devices to obtain watertight joints will not be acceptable.

2-4.07. Guiderail Mounted Base. Not used.

2-4.08. Pedestal Mounted Base. Unless otherwise indicated or specified, all equipment will be installed on concrete bases at least 6 inches high. Each pedestal mounted pump shall be mounted on a pedestal base extending from the impeller casing to below the bottom of the suction elbow inlet flange. All seams and contact surfaces between steel shapes and plates of fabricated steel pedestals shall be continuously welded and ground smooth. Each pedestal shall be suitable for grouting and bolting to the floor of the drywell.

2-4.08.01. Suction Elbow. Each pedestal-mounted pump shall be provided with a flanged suction elbow complete with a cleanout handhole with contoured interior surfaces. The elbow may be integral with the pedestal base. The diameter and drilling of the inlet flange shall conform to ANSI B16.1, Class 125.

2-4.09. Skid Mounted Base. Not used.

2-4.10. Access Hatch Cover. Not used.

2-4.11. Shop Painting. All iron and steel parts which will be in contact with pumped liquid or submerged after installation, including the inside of the casing and the discharge elbow, shall be shop cleaned in accordance with the coating manufacturer's recommendations. The exterior of the pump shall be painted with the epoxy coating system specified. The coating shall have a dry film thickness of at least 10 mils and shall consist of a prime (first) coat and one or more finish coats. At least 1 quart of the finish coat material shall be furnished with each pump for field touch-up.

All iron and steel parts inside the pump, including the surfaces of cast iron impellers, shall be painted with a suitable rust protective coating to protect the impeller during shipment, storage, and installation.

The shop painting of other surfaces shall be in accordance with the shop painting requirements in the General Equipment Stipulations.

For potable water applications, all coatings shall be NSF approved.

2-5. ELECTRIC MOTORS. Each pump shall be driven by an air-filled, totally submersible electric motor provided by the pump manufacturer. Motor nameplate rating shall exceed the maximum power required by the pump in the operating head range. Each motor shall be rated for the power supply provided to the pump, and shall have a service factor of 1.15. The stator housing shall be an air-filled, watertight casing. A cooling jacket shall encase the motor housing for each pump where needed to maintain adequate cooling. The cooling jacket shall require no external source of cooling water. Motor insulation shall be moisture resistant, Class H, 155°C. Each motor shall be NEMA Design B for continuous duty at 40°C ambient temperature, and designed for at least 10 starts per hour.

The motor bearings shall be antifriction, permanently lubricated type. The lower bearing shall be fixed to carry the pump thrust and the upper bearing free to move axially. The bearings shall have a calculated ABMA L₁₀ Life Rating of 40,000 hours when operating at maximum operating head. Maximum shaft runout at the mechanical seals shall not exceed 2 mils at any point in the operating head range.

Each motor installed in a drypit shall be capable of continuous operation in air under pump full load conditions, without exceeding the temperature rise limits for the motor insulation system.

Each pump shall be equipped with one or more multiconductor cable assemblies for power and control. Each multiconductor assembly containing power cables shall be provided with a separate grounding conductor. Each cable assembly shall bear a permanently embossed code or legend indicating the cable is suitable for submerged use. Cable sizing shall conform to NEC requirements.

All cables for drywell mounted pumps shall be of sufficient length to terminate in a junction box as indicated on the Drawings, with 10 feet of slack which will be coiled at the motor.

The cable entry water seal shall include a strain relief and a grommet type seal designed so that a specific fastener torque is not required to ensure a watertight, submersible seal. The cable entry junction box and motor shall be separated by a stator lead sealing gland or a terminal board. The junction box shall isolate the motor interior from moisture gaining access through the top of the stator housing.

Motors shall be specifically selected for service with an adjustable frequency type speed controller and shall be derated to compensate for harmonic heating effects and reduced self-cooling capability at low-speed operation so that the motor does not exceed Class B temperature rise when operating in the installed condition at load with power received from the adjustable frequency drive. All motors driven by adjustable frequency drives shall be supplied with full phase insulation on the end turns and shall meet the requirements of NEMA MG 1, Part 31. In addition to the requirements of NEMA MG 1, Part 31, motors shall be designed to be continually pulsed at the motor terminals with a voltage of 1600 volts ac.

2-5.01. Adjustable Frequency Drives. Adjustable frequency drives shall be provided and shall be coordinated with the requirements of the pumping unit. The pump manufacturer shall be responsible for furnishing the adjustable frequency drive, for matching the motor and the drive, and for coordinating the collection of data and the design to limit harmonics to the levels specified.

Adjustable frequency drives shall be design as specified in the Adjustable Frequency Drives section.

2-6. CONTROLS.

2-6.01. Liquid Level Sensors. Not used.

2-6.02. Pump Controls. Each motor shall be protected by one motor temperature switch embedded in each phase winding. Each switch shall be designed to operate at 140°C (± 5°C). Each switch shall be normally closed automatic reset type rated 5 amps at 120 volts ac. The switches shall be wired in series with end leads wired to terminals within the motor housing.

Each motor housing shall be provided with a moisture detection system complete with all sensors, control power transformers, intrinsically safe control modules, and relays. The moisture detection system shall be rated for a 120 volt ac supply. The moisture detection system shall provide two normally open dry output contacts rated 5 amps at 120 volts ac. The contacts shall close when moisture is detected in the motor housing. All moisture detections system components shall be furnished by the pump supplier and shall be shipped loose for installation into the motor controller enclosure

2-7. SHOP TESTS.

Each pump shall be tested at the factory for capacity, power requirements, and efficiency at specified rated head, shutoff head, operating head extremes, and at as many other points as necessary for accurate performance curve plotting. All tests and test reports shall be made in conformity with the requirements and recommendations of the Hydraulic Institute Standards. Acceptance testing shall be per Table 11.6.5.4 Grade 1U, with no minus tolerance or margin allowed.

Five certified copies of a report covering each test shall be prepared by the pump manufacturer and delivered to Engineer not less than 10 days prior to the shipment of the equipment from the factory. The report shall include data and test information as stipulated in the Hydraulic Institute Standards, copies of the test log originals, test reading to curve conversion equations, and certified performance curves. The curves shall include head, bhp [brake kW], pump efficiency, and shop test NPSH available, plotted against capacity. The curves shall be easily read and plotted to scales consistent with performance requirements. All test points shall be clearly shown.

2-8. MANUFACTURERS. Submersible pump shall be manufactured by Flygt or Hydromatic.

PART 3 - EXECUTION

3-1. INSTALLATION. Each pumping unit shall be installed in accordance with the Hydraulic Institute Standards, the Equipment Installation section, and as specified herein.

The equipment base for dry pit type pumping units shall be grouted after initial fitting and alignment, but before final bolting of connecting piping. Special care

shall be taken to maintain alignment of pumping unit components. No stresses shall be transmitted to the pump flanges. After final alignment and bolting, connections to pumping equipment shall be tested for applied piping stresses by loosening the flange bolts. If any movement or opening of the joints is observed, piping shall be adjusted to proper fit.

Control cables shall be supported to prevent tension and damage. Mounting of cable supports in wetwells shall be coordinated by the pump supplier. Liquid level sensors shall operate freely and shall be adjusted to the levels indicated in the respective pump schedules, or in the electrical schematics or P&ID's. Each system of sensors shall be installed complete with all required mounting brackets, weights, galvanized steel mounting pipes and accessories, control panel transformers, auxiliary relays, cables, and junction boxes.

3-2. FIELD QUALITY CONTROL.

3-2.01. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation in accordance with Section 01650, Startup Requirements, and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

All costs for these services shall be included in the contract price.

3-2.02. Installation Supervision. Installation supervision by the manufacturer is required. Manufacturers' installation supervisor shall observe, instruct, guide, and direct the installing contractor's erection or installation procedures. Installation supervisor shall provide a written letter report certifying that the pumps were properly installed and are ready for startup.

3-2.02. Field Vibration Tests. Not Used.

End of Section

Section 11910

ENGINE-GENERATOR

PART 1 - GENERAL

1-1. SCOPE. This section covers the furnishing of one diesel fueled engine-driven electric generator units designated GEN-401. The engine-generator shall be located outside in a skin tight, non-walk-in type weatherproof, level 1, sound attenuated enclosure. The engine-generator design shall be Caterpillar C18 or equal.

The engine-generator Supplier shall be fully responsible to furnish a complete and coordinated package system including the engine-generator, enclosure, microprocessor-based generator controls, exhaust silencers, batteries and chargers, sub-base fuel storage tank, digital governor, digital voltage regulator and all accessories as required for a complete operating system.

1-2. GENERAL. Equipment furnished under this section shall be assembled in full conformity with drawings, specifications, engineering data, instructions, and recommendations of the equipment manufacturer unless exceptions are noted by Engineer.

1-2.01. General Equipment Stipulations. The General Equipment Stipulations shall apply to all equipment furnished under this section. If requirements in this specification differ from those in the General Equipment Stipulations, the requirements specified herein shall take precedence.

1-2.02. Seismic Design Requirements. Seismic design requirements for products specified herein shall be indicated in the Meteorological and Seismic Design Criteria section.

1-2.03. Coordination. All equipment specified in this section shall be furnished through a single engine-generator manufacturer who shall be responsible for the design, manufacture, coordination, and delivery of the entire system. The Contractor shall be responsible for unloading, storing, and installing the equipment.

The engine-generator unit shall be a standard product of the manufacturer and shall be a packaged type unit, fully shop assembled, wired and tested, requiring no field assembly of critical moving parts.

Supplier shall verify that each component of the system is compatible with all other parts of the system; that all piping, materials, and motor sizes are

appropriate; and that all devices necessary for properly functioning system have been provided.

Supplier shall, at its own expense, arrange for and obtain all necessary permits, inspections, and approval by the proper authorities in local jurisdiction of such work.

Supplier shall properly coordinate the work between the suppliers of the equipment to be used with or connected to the engine-generator, including the switchgear modifications to ensure that all requirements are met.

Supplier shall provide field services specified to assist in commissioning, testing and placing the unit in operation in full conformity with equipment manufacturer's specifications.

1-2.04. Governing Standards. Except where modified or supplemented by these specifications, all equipment and materials shall be designed and constructed in accordance with the latest applicable requirements of the standard specifications and codes of ANSI, ASTM, EEI, EGSA, HEI, IBC, IEEE, IFC, ISO, NEMA, NFPA, SAE, STI, UL and other such regularly published and accepted standards as well as state and local codes.

The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1-2.05. Equipment Identification. All equipment, valves, devices, panels, and control equipment denoted by a symbol and an identifying number shall be provided with equipment identification tag or nameplate. Equipment identification shall be as indicated in the Equipment and Valve Identification section.

1-2.06. Manufacturer's Nameplates. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a nameplate securely affixed in a conspicuous place. The nameplate of a distributing agent only will not be acceptable.

1-2.07. Power Supply. Site power supply provided to the engine-generator enclosure for auxiliary loads shall be a single 480 volt, 60 Hz service. The manufacture shall furnish a step-down transformer and panelboard, as required, to power all loads within the enclosure.

The engine (starting and controls) will operate from batteries specified herein. When needed, a control transformer shall be provided within the panel-board for control supply.

1-3. SUBMITTALS.

1-3.01. Drawings and Data. Complete assembly and installation drawings, together with detailed specifications and data covering materials, drive unit, parts, devices and accessories forming a part of the equipment furnished, shall be submitted in accordance with the Submittals Procedures section. The data and specifications for the unit shall include, but shall not be limited to, the following:

Manufacturer, model, and type:

Engine.

Alternator.

Enclosure.

Battery charger and battery.

Fuel oil cooler (if required by engine design).

Silencer.

Emission control equipment.

Sub-base fuel storage tank.

Engine output horsepower and efficiency curves at rated capacity.

Fuel consumption at rated capacity.

Ratings at specified conditions:

Engine (net horsepower).

Engine (maximum performance horsepower bare engine).

Generator kW at specified power factor.

Volts.

Amperes.

Overall dimensions and weight:

Length.

Width.

Height.

Net weight.

Wiring diagrams and schematics, including the engine control panel.

Alternator insulation class and temperature ratings.

Alternator winding pitch.

Confirmation or test results showing compliance with specified motor starting and voltage dip requirements as well as unloading the specified loads.

Control panel layout, identifying location of all instrumentation being supplied.

Engine drawing to include location of all piping connections.

Operation instructions.

Letter from the engine-generator manufacturer confirming that the unit will provide the specified minimum kW rating at the specified design conditions and time duration including ambient temperature rise from all equipment located inside the enclosure.

Confirmation that the battery charger is sized to recharge the batteries for the specified condition and time period.

Confirmation that the starting batteries provide the specified number of start attempts for the specified time period.

Maximum output short circuit kVA available.

Letter from the engine-generator manufacturer confirming that the enclosure is suitable for the specified wind velocity and is designed as specified for rain penetration when the unit is operating.

Manufacturer and type of engine cooling antifreeze being supplied.

Exhaust gas emission data, maximum values at loads of 1/2, 3/4, and full when operating on 100 percent diesel fuel:

Carbon Monoxide (CO), lb/hr

Nitrogen Oxides (NO_x), lb/hr

Particulate Matter (PM), lb/hr

Temperature, F

Flow, acfm

Equipment skid drawing including material list.

Confirmation that the exhaust through the exhaust silencer and emissions control equipment does not exceed the specified maximum pressure loss at the specified power outage capacity of the unit.

Letter from the engine-generator manufacturer confirming that the unit is in full compliance with federal EPA, State, and Local air emission requirements.

Confirmation that the engine-generator unit, including the enclosure, louvered openings, and exhaust system will limit the noise to not exceed the specified decibel reading at the specified distance from any point from the enclosure when operating at the specified capacity.

Name, address, and phone number of manufacturer's repair facility.

Color chart showing available options for the enclosure color. The color of the enclosure shall be as directed by Owner during shop drawing review.

Drawings showing engine-generator inside the enclosure that shows location of all enclosure mounted and engine-generator mounted equipment. Drawings to indicate maintenance access clearances for electrical and mechanical equipment. Drawing to show location of all enclosures bracing and location of doors, sub-base tank fill access door, power panel door, silencer, and removable panels.

Identification of all field connections for electrical, control, or other service and associated connection requirements to be performed by the Installation Contractor.

Detailed procedures and instrument calibration reports for all items associated with the shop and field-testing activities.

Provide recommendation for mounting the engine-generator for the specified seismic parameters.

Stairs and platform drawings.

Confirmation of compliance with the requirements of the Meteorological and Seismic Design Criteria section

Letter from the manufacturer confirming site visit and indicating a item to be replaced such that nameplate capacity will be obtained from all the engine-generators.

Anchor Bolts

Generator Protection Relay recommended settings.

Detailed installation instructions for Installation Contractor.

Refer to Attachment A for a list of technical information that should be provided with the submittal.

1-3.02. Operation, Maintenance, and Repair Manual. Operation, Maintenance and Repair Manuals, including names and telephone numbers of emergency contact persons, shall be submitted in accordance with the Submittals Procedures section. The manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered.

1-4. DELIVERY, STORAGE, AND HANDLING. Shipping shall be in accordance with the Product Delivery Requirements section. Handling and storage shall be in accordance with the Product Storage and Handling Requirements Section.

1-4.01 Spare Parts. The following spare parts and accessories shall be furnished in substantial wooden boxes with identifying labels and delivered to Owner as directed:

<u>Spare Parts</u>	<u>Quantity (for each unit)</u>
Air filters.	2 sets
Oil filters.	4 sets
Fuel filters.	12 sets

V-belts.	1 set
Crankcase filter media.	1 set

If any of the above spare parts are used during the installation process, they shall be replaced by the manufacturer at no cost to the Owner.

All spare parts shall be provided in waterproof packages suitable for export service, labeled with its description and part numbers. Each item or set of parts expected to be installed at one time shall be in an individual package. The spare parts shall be stored as directed by the owner.

1-4.02. Keys. Three sets of identical keys for locks on the enclosure and all cabinets shall be provided for the engine-generator.

PART 2 - PRODUCTS

2-1. SERVICE CONDITIONS. The engine-generator unit shall be designed to operate under the following service conditions:

Seismic wind and snow design requirements including importance factor	See Meteorological and Seismic Design Criteria section
Ambient air temperature range.	19 to 115 °F
Site elevation.	25 ft

The engine-generator unit will be used as a power unit for selected electrical loads of the plant when the utility supplied power fails for minimum of 24 continuous hours and maximum of 50 hours per year.

The engine-generator shall automatically start and connect to the plant's electrical control system when initiated from automatic transfer switch as indicated on the drawings.

Fuel for the engine-generator will be furnished from a sub-base fuel storage tank associated with the engine-generator as specified herein.

The engine-generator Supplier shall provide the correct amount and grade of crankcase oil, coolant, and other fluids (except fuel) necessary for initial startup, testing and operation.

2-1-01. Engine Mounting. The engine-generator shall be attached to an associated skid suitable for mounting on top of the sub-base fuel storage tank anchored to a reinforced concrete base. The skid shall be constructed of heavy-duty steel, designed and built to resist deflection and to maintain alignment during lifting and

operation during any range of operation. Mounting holes in the structural skid shall be suitably sized to accommodate thermal expansion of the unit.

Unless otherwise recommended by the manufacturer, the engine-generator sub-base fuel storage tank package shall be attached to the reinforced concrete base using suitable number of hold down lugs and anchor bolts. The use of clamping devices to secure the sub-base tank will not be acceptable. Anchor bolts may be pre-cast in the reinforced concrete base or holes drilled into the concrete base at the required location and the anchor bolts secured with epoxy resin. Unless otherwise recommended by the manufacturer, the nuts for the anchor bolts shall be hand tighten.

2-1-02. Anchor Bolts. All field assembly bolts, anchor bolts, nuts, and washers shall be stainless steel as specified in the Anchorage in Concrete and Masonry section. All anchor bolts, nuts, and washers required for installation shall be provided by the Supplier.

2-2. PERFORMANCE AND DESIGN REQUIREMENTS. The engine-generator units shall be designed for the operating conditions and requirements as follows:

Tag numbers	GEN-401
Generator	
Minimum power rating capacity with accessories, for the generator voltage output and service conditions specified herein.	550 kW
Output frequency.	60 Hz
Output voltage.	480 V
Output power factor.	0.8
Output phase and configuration.	3 wire, solidly-grounded wye
Maximum Voltage Dip	See Performance Table
Engine Fuel Supply.	No. 2 Ultra-low Sulfur diesel
Maximum speed.	1,800 rpm
Minimum piston displacement.	1,953 in ³
Black start required.	Yes
Factory Emission Certification when operating at full load.	Tier 2
Maximum outside length of the engine-generator package including air intake plenums and radiator discharge plenums but	34.0 ft

not including access platforms.

Maximum outside width of the engine-generator package including air intake plenums but not including access platforms. 10.5 ft

Maximum overall height of the complete package including sub-base tank, engine-generator, and exhaust system. 15.0 ft

Maximum package wet weight including engine-generator, enclosure, ancillary equipment and fuel. 50 tons

Engine-generators submitted with ratings in excess of current published data will not be acceptable.

The entire engine-generator package system shall be electrically grounded with provisions to connect to a grounding system installed by others. Connection locations shall be indicated in the shop drawing submittals.

Engine performance, cooling, and all accessories to account for ambient air temperatures increase from heat rejected from all equipment located inside the enclosure.

Engine-generator unit furnished shall be of a design that can be accommodated in the space as indicated on the drawings. Maximum outside dimensions of the Engine-generator enclosure including any air intake or discharge plenums shall be as specified.

Any special fittings or piping required for connection to fuel piping shall be furnished and installed.

The engine-generator shall meet the required Environmental Protection Agency New Source Performance Standard emission regulations, the California Air Resources Board, and any other local requirement. The unit shall be certified at the factory prior to shipping.

The engine-generator supplier shall coordinate with the local air quality management authority to ensure the equipment meets all current local air emissions requirements. The engine-generator supplier shall guarantee the equipment supplied meets all local air emissions requirements in place at the time of startup. Field testing of actual emissions will be required per Section 3-3 to verify compliance with the emissions requirements.

2-2.01. Performance Tables. The engine-generator shall satisfactorily start the following loads in the listed order, while meeting the specified voltage and frequency dip:

	<u>Load Description</u>	<u>Load</u>	<u>Maximum Voltage Dip (%)</u>	<u>Maximum Frequency Dip (%)</u>	<u>Comments</u>
<u>Step 1</u>					
1.1	Misc. Bldg. Loads	30 kVA	20	20	
1.2	Motor	0.75 HP	20	20	Across the line
1.3	Motor	0.75 HP	20	20	Across the line
1.4	Motor	0.75 HP	20	20	Across the line
1.5	Motor	0.75 HP	20	20	Across the line
1.6	Motor	0.75 HP	20	20	Across the line
<u>Step 2</u>					
2.1	Motor	250 hp	10	5	VFD 110% Current Limit, 18 Pulse, 3ph
2.2	Motor	2 hp	30	30	Across the line
2.3	Motor	2 hp	30	30	Across the line
2.4	Motor	1 hp	30	30	Across the line
<u>Step 3</u>					
3.1	Motor	250 hp	10	5	VFD 110% Current Limit, 18 Pulse, 3ph
3.2	Motor	1.5 hp	30	30	Across the line
3.3	Motor	1.5 hp	30	30	Across the line
3.4	Motor	5 hp	30	30	Across the line
3.5	Motor	5 hp	30	30	Across the line

2-2-01.02. Unloading Requirements. The engine-generator shall satisfactorily unload the loads indicated above in any order one at a time while not exceeding overspeed, frequency deviation, and voltage deviation.

2-3. ACCEPTABLE MANUFACTURERS. The engine-generator shall be a current production. The engine-generator shall be manufactured by Caterpillar or Cummins or Koehler without exception.

The complete engine-generator package shall be assembled by the engine-generator manufacturer or their representative.

The manufacturer of the engine-generator unit shall have a full-time factory trained technical staff and an equipped twenty-four (24) hour service facility having all personnel and all equipment required to maintain, repair, or overhaul the engine-generator unit and associated equipment.

2-4. ENGINE-GENERATOR UNIT.

2-4.01. Engine. The engine shall be a reciprocating 4-stroke cycle compression ignition type and shall be equipped with the following:

Electronic governor for isochronous regulation of engine speed from no load to full load alternator output.

Dry type air cleaner with replaceable elements.

2-4.02. Alternator. The engine-generator alternator shall be a 4 pole, revolving field design with temperature compensated solid state voltage regulator, brushless rotating rectifier exciter system, and drip-proof construction with amortisseur windings. The alternator shall be directly connected to the engine flywheel housing, and the rotor shall be driven through a semi-flexible driving flange to ensure permanent alignment.

Frequency regulation shall be isochronous ± 0.15 Hz from no load to rated load. Voltage regulation shall be within ± 2 percent of rated voltage, steady state, from no load to full load. The momentary voltage drop shall not exceed the specified percent without starter coils dropping out or stalling the engine at any time when applying or starting the specified loads. Recovery to stable operation shall occur within two seconds.

The alternator shall have Class F insulation as defined by NEMA MG1-1.65 and temperature rise shall be within NEMA MG1-22.40 definition at rated condition.

The alternator conduit box shall be sized to accommodate the separate phase leads, neutral leads, current transformers, voltage surge arrestors and capacitors, and connections as indicated on the electrical one-lines.

The winding pitch shall be 2/3 pitch.

An alternator winding heater shall be furnished as an integral part of the engine-generator unit. Alternator winding heater shall be rated 120 volts, single phase. The alternator winding heater control system shall include an interlock with the engine-generator unit so that the heaters are de-energized at all times that the generator field is energized. The Supplier shall provide all internal alternator winding heater wiring and fused branch circuit protection.

2-4.02.01. Surge Protection. The engine-generator shall be provided with a voltage surge protection system installed in the generator terminal box or in a

separate enclosure near the generator terminal box that is located inside the enclosure.

The surge protection system shall include a surge capacitor and surge arrester. All cable required to connect the surge protection system to the generator terminals shall be furnished and installed under this section.

2-4.03. Fuel System. The engine-generator unit shall be furnished with a complete fuel system including engine-driven fuel pump, double wall sub-base fuel storage tank, engine supply and return lines, fuel maintenance system if required, and all accessories required for proper operation. All items shall be suitable for the specified fuel and located inside the enclosure and serviceable from inside the enclosure. The engine driven fuel pump shall transfer the fuel from the sub-base fuel storage tank to the engine-generator.

The complete fuel system and all fuel piping shall be suitable for the specified fuel and shall meet all NFPA, state, and local requirements.

Stainless steel flexible connectors shall be provided for the diesel fuel supply and return lines and at a minimum shall be located at each connection to the engine, upstream of the combination fuel filter/separator, and in the fuel return line to the sub-base fuel tank. The stainless steel flexible connectors shall be U.S. Hose "Model 401M" or equal.

A combination fuel filter/separator shall be located on the fuel supply line inside the enclosure between the sub-base fuel storage tank and the engine driven fuel pump, upstream from the flexible connectors. The combination fuel filter/separator shall be a manifold unit with shutoff valves and shall permit servicing the filter/separator without engine shutdown. This shall permit valving off of the filter/separator and bypassing the fuel to the other filter/separator. Filter/separator shall be manufactured by Racor or equal.

Fuel oil coolers shall be provided if the engine fuel system absorbs heat from the unit injectors and surrounding jacket water. The fuel cooler shall be a radiator mounted, air cooled unit that uses the air flow from the radiator for cooling. To prevent overheating of the fuel in the sub-base fuel storage tank, the fuel oil cooler shall be adequately sized to cool the return fuel from the engine to the required fuel inlet temperature.

The fuel storage tank shall be a rectangular sub-base type, double wall Fireguard type with solid dry type insulation between the two steel walls, shall be located below the engine-generator and shall be constructed to permit access to the electrical stub-up area. The primary tank and the secondary tank shall meet all EPA, state, and local requirements, be vented, and shall normally be used to store diesel fuel at atmospheric pressure. The primary internal steel tank and the secondary outer steel tank shall both be of welded construction throughout and each shall be UL 142 listed and labeled.

The sub-base fuel storage tank shall be Fireguard type, with two-hour fire rating and impact ballistic protection. The tank shall be UL 2085 listed, and shall meet requirements of the Uniform Fire Code 7907, and NFPA 30/30A. The tank shall be manufactured to and labeled in accordance with STI standards; no exposed concrete, spalling or cracking with a 20-year minimum warranty.

The fuel storage tank shall have a minimum usable capacity to provide for storage for 24 hours of continuous operation of the engine-generator when operating at 100 percent capacity but shall not be less than 2,500 gallons.

The secondary tank shall be closed top, encircle the tank, prevent the containment area from being contaminated, and sized to contain minimum 110 percent of the tank's capacity. All connections required for field-testing the secondary tank shall be furnished.

The fuel storage tank shall be provided with the following:

- Secondary containment tank.

- Float switch in secondary tank to indicate tank leak

- Vent cap.

- Primary tank emergency vent.

- Secondary tank emergency vent.

- Level gauge that is capable of measuring fuel level without engine running and is viewable from the manual fill connection.

- Fill spill containment box and pump out with cap.

- Automatic shutoff valve, dry type quick fill coupling and check valve on the fill line.

- Cap for pump out connection.

All connections for the sub-base fuel storage tank shall be located inside the enclosure and on top of the tank. The fuel storage tank shall be provided with the following connections:

- Engine fuel supply.

- Engine fuel return.

- Manual fill.

- Minimum 2-inch tank pump out with cap. Pump out line to extend to within 2 inches of the bottom of the tank.

- Primary tank vent.

- Secondary tank vent

Level gauge with transmitter for remote level indication on the engine control panel.

Primary tank emergency vent.

Secondary tank emergency vent.

Low level switch.

Leak detection.

High level float with externally mounted alarm horn and silencer button located near the fill connection.

High-high level switch (if required for automatic shutoff of the fuel fill).

Secondary tank testing with cap.

Minimum 3-inch connection with suitable screwed cap or blind flange for tank access.

Two 2-inch spare connections with caps.

The fuel storage tank shall have instrumentation suitable for the geometric configuration of the tank that includes, but is not limited to the following:

Level indication readout on the engine control panel with contact for transmission of a remote 4-20 mA signal for remote level indication. Power, if required, shall be pre-wired and fed from the engine-generator local control panel.

Level switch with electrically isolated dry contacts for remote leak detection of the primary tank shall be provided with feedback to the engine control panel.

Low level switch with electrically isolated dry contacts for remote low level annunciation on the engine control panel. The Low Fuel alarm shall be set to annunciate when 25 percent or less of the tank's capacity is remaining in the tank above the engine supply connection.

High level switch for annunciating audible alarm at 90 percent capacity in the fuel storage tank. Audible alarm horn and silence button shall be located near the fill connection.

High-High level switch with electrically isolated contacts to shut off an electrically operated valve if used in the fill line at 95 percent capacity in the fuel storage tank.

One common, isolated, dry contact to close for any fuel system alarm. A comprehensive fuel tank overfill protection system shall be provided as described herein. All devices and components shall be pre-wired from the system control panel with feedback to the Generator Control Panel as indicated.

Set at 90 percent tank capacity, the High Fuel alarm shall provide an audible alarm near the connection to alert the fill operator to prevent overfill of the tank.

A silence button shall be provided to silence the alarm horn, automatically resetting when the fuel level has dropped below the high level condition.

The fuel storage tank fill line shall include a suitable means for automatic shutoff of the fill line when 95 percent of the tank capacity has been reached. If electric operated valve is used, it shall be AC powered and be interlocked with the High-High level switch. The fill system including piping, fittings, and the automatic shut off valve shall be suitable for a pumped flow from a fill truck.

Tank fill connection, pump out connection, and level gauge shall be accessible from ground level, through a lockable access door in the enclosure. A fill spill containment box shall be provided for containment of spillage during tank fill or tank pump out.

The fill system including piping, fittings and the automatic shutoff valve, shall be suitable for a pump flow from a fill truck. The fill connection shall include a dry type quick disconnect coupling sized to accommodate the local fuel distributor.

A ground stud for the fuel truck shall also be supplied.

A suitably sized vent connection and vent cover shall be provided for the storage primary tank vent and for the secondary tank vent. Each vent cover shall be installed outside the enclosure. The cover shall have an aluminum body, screen over the outlet, and shall prevent rain from entering the vent line.

Suitable sized emergency vent connections for the primary and secondary tank and emergency vents shall be provided for the fuel storage tank. The emergency relief vent shall be installed outside the enclosure and shall be designed as required to relieve excessive internal pressure caused by fire exposure.

Each vent line and each emergency relief vent line shall be routed up on the inside of the enclosure and shall terminate just above the enclosure.

All electrical components that are furnished as part of the fuel system shall be wired by the engine-generator Supplier to either the fuel system controls and/or the local engine-generator control panel. The fuel system controls shall be powered from the power panel specified in this section. Power supply wiring to all components of the fuel system shall be provided and installed by the engine-generator Supplier.

2-4.04. Exhaust System. The engine-generator unit shall be furnished with a complete exhaust system including an all SS exhaust silencer or if required an all SS diesel particulate filter/silencer, all exhaust piping, stainless steel bellows expansion joints, and accessories required for a complete operating system. The entire exhaust and emission control system shall be designed and sized by the

engine manufacturer to comply with all emission requirements. Emission control equipment shall be provided by the engine-generator manufacturer.

If required, the exhaust particulate filter/silencer shall be provided as required to meet all Federal, State, and Local emission requirements.

All exhaust piping shall be Schedule 10S, AISI Type 304L stainless steel with butt-welded fittings.

The silencer shall be all welded AISI Type 304L stainless steel construction. The exhaust silencer shall be furnished with suitable stainless steel bracket supports for horizontal mounting inside the enclosure. The silencer shall be sized so that the back pressure at rated capacity of the engine does not exceed half the manufacturer's maximum allowable back pressure. The exhaust from the engine shall enter either the bottom or side. Silencers shall be Maxim "M51", Nelson "300" or equal.

The silencer shall be provided in order to meet the overall engine-generator unit noise emissions requirements specified in Section 2-4.14.

The exhaust silencer if located inside the enclosure and all exhaust piping inside the enclosure shall be thermally and acoustically insulated with a removable insulation.

The exhaust shall discharge vertically at the silencer outlet. A rain cap shall be provided to prevent rain from entering the exhaust pipe. The rain cap shall open from exhaust pressure from the engine and shall close when exhaust flow stops. The cap shall be stainless steel counter-balancing with vertical discharge.

Exhaust emission test ports shall be provided in the exhaust piping after the silencer. Ports shall be threaded and shall be provided with stainless steel threaded plugs or caps.

2-4.04.01. Exhaust Particulate Filter and Silencer. If required to meet local emissions requirements, the exhaust particulate filter/silencer shall reduce the diesel engine exhaust emissions or shall be provided in order to meet the overall engine-generator unit noise requirements specified in Paragraph 2-4.14. The particulate filter/silencer shall be a continuously regenerated diesel particulate filter without requiring manual intervention. Regeneration shall occur during normal engine operation once an exhaust temperature of 750 F is reached.

The particulate filter/silencer housing shall be constructed of all welded AISI type 304L stainless steel with suitable stainless steel bracket supports for mounting on top of the enclosure. The particulate filter/silencer shall be designed to contain multiple filter elements and shall be provided with an access door to the filters. The doors shall be easily removed without the assistance of lifting

equipment and be located for easy access without removing of the particulate filter/silencer. The door shall be provided with gaskets to prevent exhaust gas from leaking to the atmosphere. Connection to the engine exhaust system shall be via standard ANSI 150# pattern flanges.

2-4.05. Starting System and Control Power. The engine-generator unit shall be furnished with a complete electric motor start system including starting motors, battery pack with rack, cables, and battery charger.

The batteries shall be of the high rate, nickel-cadmium type and have a 24 volt output. The batteries shall be electrically sized for the specified design conditions or electrically sized for the engine furnished using electric strip heaters to maintain minimum cell voltages of 0.65 volt per cell during initial starting, and 0.85 volt per cell throughout the cranking time for five consecutive starting attempts of 10 seconds each. Battery voltages shall be maintained under the conditions specified herein.

The battery charger shall be suitable for the nickel-cadmium battery pack. The charger shall have a DC output suitable to supply power for all continuous loads and to recharge the batteries from a fully discharged state to normal operating voltage within 8 hours. The battery charger shall be provided with a NEMA 2 corrosion resistant enclosure. The battery charger shall be provided with the following: on/off switch, DC ammeter, DC voltmeter, AC input and DC output circuit breakers or fuses, floating voltage equalization, equalizing timer, and relays with form c contacts for remote annunciation of loss of AC power, low battery voltage, and high battery voltage.

The batteries, battery rack, and battery charger shall be located inside the engine-generator enclosure. The battery rack frame shall be constructed of corrosion resistant material.

The engine-generator shall automatically supply power to the remote bus that powers the battery charger when it is operating and when utility power is not available.

If electric strip type heaters are used due to the design conditions, they shall be thermostatically controlled and be sized to maintain the batteries at 50°F with a winter ambient temperature inside the enclosure as specified here in. The strip heaters shall be powered from the panel board specified here in and shall be wired by the engine-generator supplier.

2-4.06. Cooling System. The engine-generator unit shall be cooled with unit-mounted radiator cooling system complete with radiator, expansion tank, water pump, belt-driven fan, fan guard, thermostatic temperature control, high-water temperature cutout, electric jacket water heater and all accessories required for proper operation. The radiator shall be sized with sufficient capacity for cooling

of the engine and all other accessories required for proper operation including the ambient air temperate rise inside the enclosure. The fan shall draw air over the engine and discharge through the radiator.

The cooling system shall be filled with a permanent antifreeze mixture of the ethylene glycol type with rust inhibitor suitable for the service conditions specified herein.

The electric jacket water heater shall be furnished to maintain jacket water at 90°F with a winter ambient temperature as specified herein. The jacket water heater shall be thermostatically controlled.

The jacket water heater shall be powered from the panelboard supplied in this section and shall be wired by the engine-generator Supplier.

2-4.07. Enclosure. The engine-generator unit, including control panel, battery rack, battery charger, transformer, panelboard, sub-base fuel storage tank, and other ancillary equipment, shall be housed in a weatherproof, sound attenuated, enclosure of the non-walking type. The enclosure shall be shop mounted on its engine-generator skid or field erected by the Supplier.

The enclosure shall be designed to permit routine maintenance of engine-generator and ancillary equipment. Proper clearance must be maintained in front of all electrical equipment per the National Electric Code (NEC) and the Basic Building Code (BOCA).

The enclosure shall be designed to withstand the specified conditions as defined in the Meteorological and Seismic Design Criteria Section.

The enclosure shall be as manufactured by Pritchard-Brown or equal.

2-4.07.01. Enclosure Fabrication. The enclosure shall consist of two side walls, two end walls, and roof. The roof shall be braced as necessary to support the exhaust system. All bracing and reinforcing members shall be integral to the enclosure.

The enclosure shall be constructed of either steel or aluminum. Steel enclosure shall be constructed with a support frame of not less than 14 gage steel and roof panels of 16 gage.

Aluminum enclosure shall be formed sheet aluminum construction, made of modular panels and louvers. Posts, rails, channels, and roof bows shall be 6061-T6 extruded aluminum. The panels shall be 0.040-inch thick minimum.

The enclosure shall be rain proof type as defined by UL2200 and shall prevent the wetting of live parts when the unit is operating. If required to meet the rain

penetration requirements, "rain resistant" louvers, vertical air turning plenums or a combination of the two shall be provided. Roof shall be cambered to prevent rain water accumulation.

The enclosure walls shall be reinforced to support the plenums. Plenums shall utilize bracing as required to prevent vibration and damage from the specified wind velocity. The total assembly of generator set, enclosure, and sub-base fuel tank shall be designed to be lifted into place using spreader bars.

A minimum of four separate doors, two per side, shall be provided and located for easy maintenance access to the engine-generator, controls, and accessories. If required, access door shall be provided in front of the auxiliary power terminal box, control panel, and panel board to permit access and working space from outside the enclosure when the door is open.

Doors shall be lockable with stainless steel hardware, include retainers to hold the door open during service and the maximum width of each individual door shall not exceed three feet.

Access service platforms along each long side of the enclosure and shall be as tall as the sub-base tank.

Access platforms and stairs shall be of stainless steel and aluminum construction. The access platforms shall be four (4) feet wide and shall be located on each side of the enclosure with individual stairs to each platform. Suitable brackets shall be welded to the enclosure at the factory for field-bolting the access platforms or stairs onto the brackets on the enclosure. Stairs and handrails shall not prevent the enclosure doors from opening fully.

The access platforms shall provide access to all doors including enclosure doors and fuel fill door.

The service platforms or stairs shall be OSHA compliant and shall be provided by the engine-generator manufacturer.

The entire enclosure, except for the louvered openings, shall be provided with noise suppression insulation.

The enclosure shall be provided to meet the overall engine-generator unit noise emission requirements as specified in Section 2-4.14. Field sound level tests shall be performed on the unit as specified in Section 3-3.02.

Roof penetrations for the installation of the silencer system, all sub-base tank venting shall be gasketed to prevent the entrance of rain.

Suitable OSHA approved access service platform shall be provided to access the interior of the enclosure. Access platform shall be of all aluminum construction.

The access platform shall be located on each side of the enclosure with individual stairs to each platform. Suitable brackets shall be welded to the enclosure at the factory for field-bolting the access platform onto the brackets of the enclosure. Stairs and handrails shall not prevent the enclosure doors from opening fully.

The sub-base fuel storage tank fill connection location shall be accessible from either ground level, an access platform, or stairs through a lockable access door located on the northwest side of the enclosure as indicated on the drawings.

Engine oil and coolant drains shall be piped to the side of the skid, with lockable shutoff valves and caps. All enclosure penetrations shall be gasketed or sealed to prevent the entry of rodents.

Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

The enclosure shall be cleaned and painted as specified herein.

All enclosure doors shall be equipped with intrusion switches wired together to provide remote indication of when a door is open. Switches shall be rated for 120VAC, 5 amps.

2-4.07.02. Enclosure Ventilation. The enclosure shall be provided with intake and exhaust louvers with dampers to open on engine start. Louvers and dampers shall be sized for the cooling air requirements. Louvers shall be AC powered closed and spring open on unit start. The louvers shall be screened from the inside to prevent the entry of birds. The louvers shall be pre-wired, requiring only connection to the panel board specified in this Section.

The enclosure shall be provided with vertical air turning plenums for cooling air intake. The air inlet turning plenum shall be located on the end of the enclosure opposite the radiator discharge plenum.

The enclosure shall be provided with vertical air turning plenums for radiator discharge air. The radiator discharge plenum shall direct the air and mechanical noise upwards away from the unit, and shall be supplied with a bottom sump area, with a 1-inch drain and shutoff valve to remove any moisture.

2-4.07.03. Electrical. The enclosure shall be completely pre-wired, requiring only a 480V external connections to the enclosure to power all enclosure loads. A step-down transformer and panel board shall be provided as required and located within the generator enclosure. All circuits shall be routed in electrical metallic tubing with galvanized boxes and hardware.

The enclosure shall be provided with a minimum of four, two per side, 120 volt, 20 amp, duplex grounded receptacles.

Interior AC/DC operated maintenance lights, controlled with a 1 hour wind-up timer switch shall be provided.

2-4.08. Crankcase Vent Blow-By Absorber. Suitable crankcase breather system shall be provided by the engine-generator manufacturer to remove oil mist from the crankcase emission prior to induction in to the air intake system. The system provided shall meet the applicable level emission requirements.

2-4.09. Engine-Generator Local Control Panel. The engine-generator unit shall have a control panel mounted inside the enclosure with panel mounted controls accessible when the enclosure doors are open. The panel shall be provided with vibration isolators to prevent damage to the instruments from engine-generator vibration.

Adequate clearance shall be provided between the panel and the engine to allow engine maintenance without moving the control panel.

The control panel shall be automatic and safety type and shall, at a minimum, include all items required by NFPA 110, Level 1. In addition, the control panel shall be provided with the following instrumentation and controls:

Tachometer.

Non-resettable hour meter.

AC voltmeter, AC ammeter, voltmeter/ammeter selector switch with "off" position.

Two normally open dry contacts which close when the engine is running and open with it is stopped.

Dry contact that closes for remote common alarm.

Dry contact that closes when the control selector switch is in "Auto" mode.

Three-position selector switch with "RUN-OFF-AUTO"

Indicating lights with common alarm for the following:

Sub-base tank low fuel level.

Sub-base tank leak detection.

Sub-base tank continuous reading level.

Dry contact for common fuel alarm.

Contacts for a remote two position maintain contact emergency shutdown switch.

The control panel shall be provided with a three-position selector switch with the following positions: "RUN-OFF-AUTO". In the "RUN" position, the engine starting sequence shall be initiated providing local control for maintenance, in the "AUTO" position, the engine-generator will be remotely started and stopped by a run contact from the Automatic Transfer Controller System.

2-4.10. Emergency Shutdown Control Station. A remotely located emergency shutdown control station shall be furnished under this section and connected to the engine-generator control panel. The control station when activated shall shutdown the engine generator regardless of the position of the "RUN-OFF-AUTO" selector switch. Control wiring between the control station and the engine-generator control panel shall be furnished by the installing Contractor.

2-4.11. Auxiliary Power Panelboard. The engine-generator unit shall have a 480-120/208 or 120/240 volt, dry-type, step-down transformer, sized by the manufacture, and 120/208 or 120/240 volt panelboard with main and branch circuit breakers rated as required. The panelboard enclosure shall have a Door-In-Door hinged trim cover. The panel board and transformer shall be mounted inside the enclosure and isolated from generator vibration.

The panelboard shall be provided with a main circuit breaker and branch circuit breakers that will power the required loads inside the enclosure as specified herein. A minimum of 4 spaces for future breakers shall be provided. The panel board shall be pre-wired to all engine-generator accessories.

The panel board shall supply power to the services including but not limited to the following:

- Engine-generator starting system battery charger.
- Enclosure lights and receptacles.
- Fuel System
- Enclosure intake and exhaust louvers/dampers.
- Engine jacket water heater.
- Alternator winding heater.
- Battery pad heater for starting batteries (if required).
- Local control panel.

The panelboard shall have an integral surge protection device rated for high exposure.

2-4.12. Generator Component Overcurrent and Differential Protection.

A generator line circuit breaker rated for the generator output voltage, having the trip rating indicated on the drawings, shall be provided on the output terminals. The line circuit breaker shall be pre-wired to the generator output terminals and shall be provided within the generator enclosure.

Overcurrent protection devices shall be provided as needed by the system design to protect generator rotor and excitation system components.

2-4.13. Limiting Dimensions. The engine-generator unit furnished shall be of a design that can be accommodated in the space available as specified herein and as shown on the Drawings.

2-4.14. Noise Emissions. The engine-generator unit, including the enclosure, louvered openings, and exhaust system, shall be designed to limit the noise emissions to not exceed the A-weighted sound pressure level of 75 dB (A) at 23 feet from any point of the engine-generator unit and shall meet all local noise requirement, whichever is more stringent, when operating at the specified capacity when operating alone, and when measured in accordance with industry standards such as but not limited to ANSI S12.18, ASME PTC 36, and ISO 8528-10.

2-5. SHOP PAINTING.

2-5.01. Engine-Generator. All steel and iron surfaces shall be protected by suitable coatings applied in the shop. Surfaces which will be inaccessible after assembly shall be protected for the life of the equipment. Coatings shall be suitable for the environment where the equipment is installed. Exposed surfaces shall be finished, thoroughly cleaned, and filled as necessary to provide a smooth, uniform base for painting. Electric motors, engine, alternator, enclosure, piping, and valves shall be shop primed and finish painted prior to shipment to the site.

Stainless steel, nonferrous, and nonmetallic surfaces shall not be painted.

2-5.02. Enclosure. The enclosure shall be thoroughly cleaned after assembly, etched, and shop painted, both interior and exterior surfaces. The enclosure shall be painted according to the manufacturer's standard practices with the interior receiving at least one coat of ANSI gray and the exterior paint thickness shall be 3 mils minimum. Paint colors shall be selected by the Owner.

2-6. SHOP TESTS. The manufacturer shall shop test the engine-generator with its local control panel, unit mounted radiator, and emissions control system to demonstrate that the equipment conforms to the specified requirements for load

capacity using a load bank at the specified frequency, voltage, phase and power factor.

All items included on the unit mounted local control panel shall be assembled, wired, and tested in the manufacturer's shop.

At a minimum the tests shall consist of repeated starts and stops, operation under a load bank at specified capacity frequency, voltage, phase, and power factor for a minimum of four continuous hour, and tests to demonstrate that each safety shutdown device is working properly.

Upon completion of all testing, Supplier shall submit certified copies of the shop test results prior to shipping the unit.

Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner. Supplier is responsible to provide two weeks' notice for testing.

2-7. OPERATION INSTRUCTION. Step-by-step instructions shall be furnished by the engine manufacturer. The instructions shall include, but not be limited to, the following procedures or information:

Startup of the unit.

Normal shutdown of the unit.

Emergency shutdown of the unit.

Normal operation of the unit, typical temperatures, pressures, speed, etc., for gauges and instruments which are displayed on the panel.

The operation instructions shall be submitted for review in accordance with the Submittals Procedures section. When the review is complete, the instruction sheets shall be printed on heavy paper or cardboard stock and laminated with clear plastic. Two copies of the laminated instructions shall be furnished. One copy shall be located or displayed at the control panel for the unit. The reserve copy shall be delivered to Owner. The instructions specified here are in addition to the operation and maintenance manuals required by the Submittals Procedures section.

2-8. AIR EMISSION PERMIT. Supplier shall be responsible for preparing and submitting air emission permits applications on behalf of the Owner to the local air quality authority for the unit being supplied base on the maximum number of operation hours and the guaranteed emissions.

The permit shall include provisions for the Owner to contact the local air quality authority to operate the unit in the event the permit hours may be exceeded due to unforeseen emergency conditions.

PART 3 - EXECUTION

3-1. INSTALLATION. The engine-generator shall be installed by the Installation Contractor per the written instructions of the manufacturer as included in the shop drawing submittals. Additional requirements of the System Supplier are as specified herein.

The exposed finish shall be inspected after completing system installation, including pipe connections, fittings, valves, and specialties. Burrs, dirt, and construction debris shall be removed and any damaged finishes, including chips, scratches, and abrasions shall be repaired.

3-2. FIELD QUALITY CONTROL.

3-2.01. Installation Check. An experienced, competent, and authorized representative of the manufacturer shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. The representative shall be present when the equipment is placed in operation, and shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of Engineer.

The manufacturer's representative shall furnish a written report certifying that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; and has been operated under full load conditions and that it operated satisfactorily.

All costs for these services shall be included in the contract price.

3-3. FIELD TESTING. Manufacturer's field services shall be provided for field testing. All costs for these services shall be included in the contract price.

3-3.01. Performance Test. The unit shall be mechanically checked for proper operation. The alarm and safety shutdown shall be checked by artificially simulating an alarm condition. Defective equipment and controls disclosed by the tests shall be replaced or corrected, and the packages placed in satisfactory operating condition.

The engine-generator set shall be tested to demonstrate that the equipment conforms to specified requirements for capacity and starting duty and guaranteed air emissions.

The complete system (engine, generator, exhaust system, starting system, fuel system and sub-base fuel storage tank, and control panel) shall be field tested together by the manufacturer as a complete system to assure compatibility.

The unit test shall consist of repeated starts and stops, operation under a plant loads at the specified power factor rating for the duration of indicated below.

Before each of the following tests, the engine shall be brought to steady state condition as determined by the instrument readings:

- Successfully demonstrate four consecutive start, run and stop sequences of the unit without any alarm conditions.
- Demonstrate that each safety shutdown device is working properly.
- Four continuous hours at specified power rating and power factor within normal operating conditions of the unit without any alarm conditions. This period will also be used for any emissions testing as documented herein.
- Four starts of the specified electrical loads in the order listed without exceeding the maximum voltage drop allowance followed by 30 minutes of continuous operation per start within normal operating conditions of the unit without any alarm conditions.
- Four consecutive, successful transfers to and from utility power.
- Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service and observing proper operation of the system for at least two hours.
Coordinate timing and obtain approval for start of test with site personnel

Contractor will furnish the fueling, lubricants and load bank for initial tests.

At the option of the Owner, an independent laboratory will be provided by the Owner for the exhaust gas sampling and analysis. Testing will be conducted during the load test when operating on diesel fuel. The laboratory analysis will be used for verification the unit meets the guaranteed emissions.

Any retesting or modifications to the equipment to meet the above requirements and emission guarantees shall be approved by the Engineer. All costs of modifications and retesting, including the independent laboratory for air emission testing, shall be at no cost to the Owner.

In addition to the required emission levels being monitored, the following items shall be measured, recorded at 15-minute intervals, and submitted in a field test report:

Outdoor ambient temperature.

kW output.

Engine speed, rpm.

Engine jacket water temperature.

Engine oil pressure.

Start time.

Completion time.

Test reports shall verify that the specified tests have been performed and shall state results. Test results shall be submitted as required in the Submittals Procedures section.

3-3.02. Field Sound Level Test. The installed equipment shall be tested for noise during the four-hour test. The measured engine-generator sound levels shall not exceed whichever sound level is more stringent between the sound level specified herein or the maximum local sound level allowed when the unit is operating. Compliance with the noise emission requirement shall be determined in accordance with industry standards including ASME PTC-36. Compliance shall be based on not exceeding the allowable sound pressure level including background sound corrections per Section 4-2.6 of ASME PTC-36 and excluding any correction for measurement uncertainties.

Any retesting or modifications to the equipment exhaust silencer or enclosure to meet the above requirements shall be approved by Engineer. All costs of modifications and retesting shall be at no cost to Owner.

Test reports shall verify that the specified tests have been performed in accordance with the referenced standards and shall state results. Test results shall be submitted as required in the Submittals Procedures section.

3-4. TRAINING. The manufacturer shall conduct on-site training to instruct Owner on operation and maintenance of each unit. The training shall be arranged and coordinated with Owner through the System Supplier. All costs for these services shall be included in the Contract Price.

The training program shall consist of two sessions with a minimum duration of 4hrs each session for a class size up to ten persons selected by Owner.

For each training session, approximately half the time should be spent in a classroom environment and the other half in a hands-on environment.

A detailed outline of the material to be covered during each training session and training materials are to be submitted to the Engineer at least one month before the start of training for review, comment, and approval. The equipment representative shall provide an adequate number of printed trainee materials for all persons being trained.

3-5. WARRANTY. The System Supplier shall guarantee that the all components of the system including the engine-generator, emissions control system, enclosure, control system, and all equipment specified herein and all ancillary

equipment, shall perform to the conditions specified herein or in the respective equipment section.

The guarantee period shall be five years after the date of Substantial Completion by the Installation Contractor. If within the guarantee period, any system component is found to be defective, the System Supplier shall promptly, without cost to the Owner, satisfactorily correct or repair such defective work. No deductibles should be allowed for travel time, service hours, repair cost, etc.

3-6. INITIAL TANK FILL. Upon satisfactory completion of all work, the Contractor shall fill the sub-base tank with the specified fuel.

End of Section

11910- Attachment A - Manufacturers Technical Fill-in Form

	Parameter/Requirement	Supplier
1	Manufacturer and model:	
1a	Engine	
1b	Alternator	
1c	Enclosure	
1d	Fuel Storage Tank (Type)	
1e	Silencer or Particulate Filter/Silencer	
2	Fuel consumption at rated capacity, gpm	
3	Ratings at specified conditions:	
3a	Engine (net horsepower)	
3b	Minimum power rating capacity with accessories, for the generator voltage output and service conditions specified herein.	
3c	Output voltage.	
3d	Output power factor.	
3e	Output phase and configuration.	
3f	Maximum engine speed, rpm	
3g	Engine minimum piston displacement, cu in	
3h	Factory emission certification when operating at full load	
4	Package:	
4a	Maximum outside length dimensions of the engine-generator package including air intake plenums and radiator discharge plenums but not including access platforms, in	
4b	Maximum outside width dimensions of the engine-generator package including air intake plenums but not including access platforms or stairs, in	
4c	Maximum overall height dimensions of the complete package including sub-base tank, engine-generator, and exhaust system, in	
4d	Is sub-base fuel storage tank a Fireguard type?	

	Parameter/Requirement	Supplier
4e	Sub-base fuel storage tank capacity, gal	
4f	Sub-base fuel storage tank dimensions (LxWxH), in	
4g	Maximum package wet weight including engine-generator, enclosure, ancillary equipment and fuel, lbs	
4h	Maximum enclosure rated wind velocity, mph	
5	Confirmation from the engine-generator manufacturer that the unit will provide the specified minimum kW rating at the specified design conditions and time duration including ambient temperature rise from all equipment located inside the enclosure.	
6	Confirmation NiCAD batteries are being supplied.	
7	Confirmation from the engine-generator manufacture confirming that the unit is in full compliance with federal EPA, State, and Local air emission requirements.	
8	Confirmation that the engine-generator unit, including the enclosure, louvered openings, and exhaust system will limit the noise to not exceed the specified decibel reading at the specified distance from any point from the enclosure when operating at the specified capacity and meet local noise requirements.	
9	Confirm compliance with the Meteorological and Seismic Design Criteria section.	
10	Spare Parts Being Provided (Quantity)	
10a	Air filter sets	
10b	Oil filter sets	
10c	Fuel filter sets	
10d	V-belts sets	
10e	Crankcase filter media sets	
10f	Additional Spare Parts	

