

ADDENDUM NO. 1

TO: ALL PLAN HOLDERS

RE: City of Dierks, Arkansas
Water System Improvement Project

ADDENDUM DATE: October 30, 2024

The Plans, Specifications and Contract Documents for the above referenced project are hereby modified as follows:

1. **Bid Date Proposal Revised. Remove and replace page 8 of the bid proposal with the attached.**
2. **Remove the Technical Specifications "Attachment A" and replace with the attached.**

ADDENDUM NO. 1 ISSUED BY:

A.L. FRANKS ENGINEERING

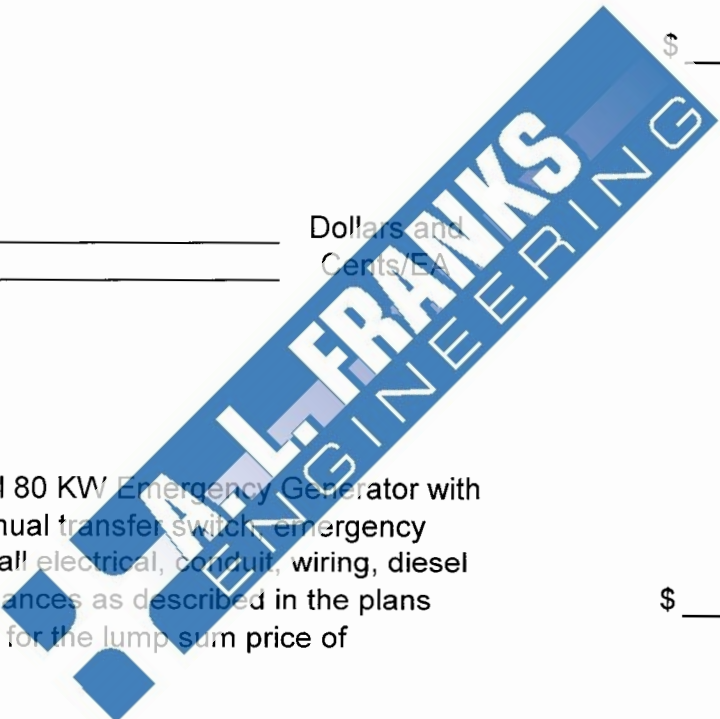


Kiron Browning, P.E.
Project Manager

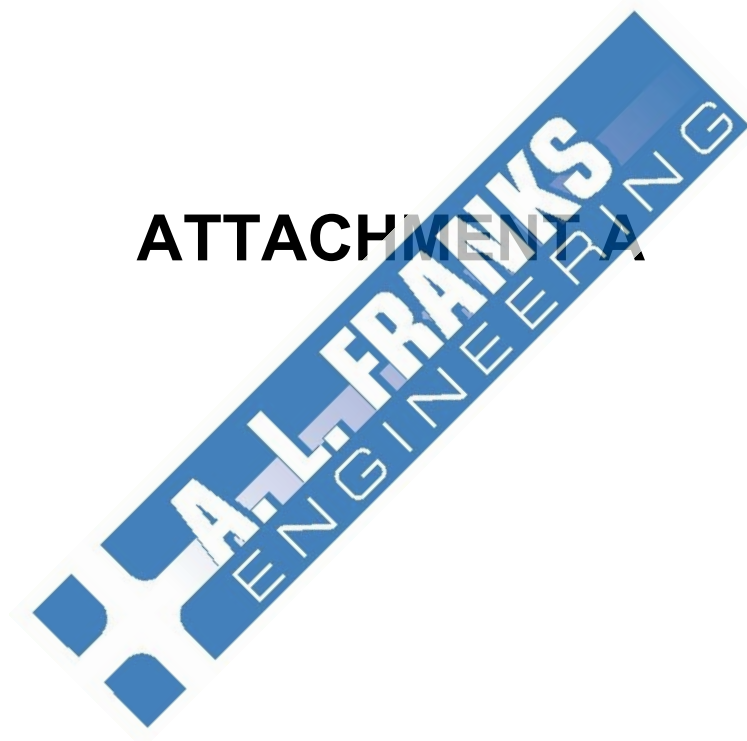


BID PROPOSAL CONTINUED

ITEM	QTY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL PRICE
13	5	EA	Re-connect Existing 3/4" Long Side Water Service to main per plans and specifications for the unit price of	\$ _____	\$ _____
			_____ Dollars and _____ Cents/EA		
14	1	L.S.	Furnish and Install 80 KW Emergency Generator with concrete pad, manual transfer switch, emergency lighting, including all electrical, conduit, wiring, diesel fuel, and appurtenances as described in the plans and specifications for the lump sum price of	\$ _____	\$ _____
			_____ Dollars and _____ Cents/LS		



ATTACHMENT A



Date: October 16, 2024

Reference: Dierks- PS

Equipment Proposed:

Quantity 1 - Generac Industrial diesel engine-driven generator set with turbocharged 4-cylinder 4.5L engine, consisting of the following features and accessories:

- Stationary Emergency-Standby rated
- 80 kW Rating, wired for 120/240 VAC three phase, 60 Hz
- Brushless Excitation
- With upsized 130 kW alternator
- UL2200
- EPA Certified
- SCAQMD
- Standard Weather Protective Enclosure, Steel
 - Industrial Grey Baked-On Powder Coat Finish
- 24" 189 Gallon Double-Wall UL142 Base tank
 - Mechanical fuel level indicator gauge
 - Electronic fuel level sender
 - Emergency Vents
- Power Zone 410 Digital Control Panel for Single Generators
 - NFPA 110 Capable
 - Temp Range -40 to 70 degrees C
 - UL6200
 - C-ETL-US
 - CE
 - 128 X 64 Graphical Display with Heater
 - Auto/Manual/Off modes
 - Optional Emergency Stop, key switch (Auto/Off/Manual) and audible alarm horn within a single add on module
 - RS-485, RS-232 and CANbus ports
 - Sensors: Oil Pressure, optional Oil Temp, Coolant Temp, Fuel Level/Pressure (where applicable), Engine Speed, DC Battery Voltage, Run-time Hours, Generator Voltages, Amps, Frequency, Power, Power Factor
 - Alarm Status: Low or High AC Voltage, Low or High Battery Voltage, Low or High Frequency, Pre-low or Low Oil Pressure, Pre-high or High Oil Temp (optional), Low Water Level and Temp, High, Low, and Critical-low Fuel Level/Pressure (where applicable), Overload, Overcrank, Over and Under Speed, Unit Not in Automatic
 - Optional Programmable I/O module
 - Engine function monitoring and control:
 - Full range standby operation; programmable auto crank, Emergency Stop (optional), Auto-Off-Manual
 - 3 Phase RMS Voltage Sensing
 - +/-0.5% digital voltage regulation with: soft-start voltage ramping - adjustable, loss of sensing protection - adjustable, negative power limit - adjustable, Hi/Lo voltage limit - adjustable, V/F slope and gain - adjustable, fault protection
 - Service reminders, fault history (alarm log)
 - I2T function for full generator protection

- Selectable low-speed exercise
- 2 and 3-wire start controls for any 2 or 3-wire transfer switch
- Standard MLCB, 80% rated thermal-magnetic
 - 300 Amp
- Primary MLCB, 80% rated thermal-magnetic
 - 300 Amp
- Battery Charger, 10 Amp, NFPA 110 compliant, installed
- 110 AH, 925 CCA Group 31 Battery, with rack, installed
- Coolant Heater, 1500W, 120VAC
- Crankcase Oil Heater, 200W, Shipped Loose
- 120v GFCI and 240V Outlet
- 3 Owner's Manuals
- Standard 2-Year Limited Warranty
- SD0080JG174.5D18DBYY3

Quantity 1 - TX Series Automatic Transfer Switch consisting of the following features and accessories:

- 400 Amp, 3 pole, 120/240 VAC three phase, 60 Hz, with 2-Wire Start Circuit
 - Utility Voltage Sensing Controls:
 - Adjustable Drop-out and Pick-up
 - Adjustable Utility Interrupt Delay
 - Adjustable Logic Controls:
 - Minimum Standby Voltage
 - Minimum Standby Frequency
 - Engine Warmup
 - Return to Utility
 - Engine Cooldown
 - Transfer on Exercise
- 3 Owner's Manuals
- Double Set of Form C Aux Cont
- IBC Seismic Certified
- Specific Breaker
- Withstand and Close-On Rating - 65kA Specific Breaker
- Enclosure Heater
- UL Listed 1008 by ETL
- Controller and Circuit Breaker Covers, Padlockable, Black
- NEMA 3R Enclosure
- Service Entrance Rated
- Specific Breaker
- In Phase Only Transfer
- Standard two year basic warranty
- TX301NS0400J3CH

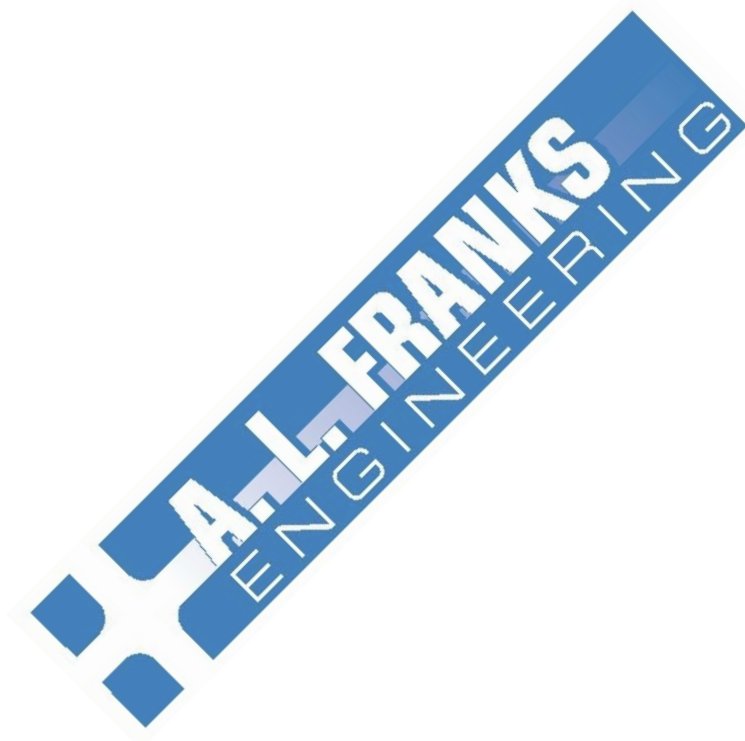
Quantity 1 - Freight

Quantity 1 - Startup 0036-100kW Range

- The above price includes an onsite start-up inspection. All electrical and mechanical connections should be completed at the time of start up request. This includes exhaust systems, fuel piping, remote annunciators and any other system accessories. If an extra start up inspection is required because of incomplete installation, it will be invoiced at our prevailing labor and mileage rates. Clifford Power Systems, Inc. (CPS) will provide a pre-start up checklist to be filled out by the installing contractor upon completion of installation, and returned to CPS for start up scheduling. Start up must be performed within one year of shipment to validate the generator warranty.

Project Management Services

- Factory load bank testing
- Submittal drawings
- Dimensional drawings, Electrical drawings, Product specifications
- Production testing
- Technical assistance
- Operation and maintenance manuals for engine, generator



Standby Power Rating
 80 kW, 100 kVA, 60 Hz

Prime Power Rating*
 72 kW, 90 kVA, 60 Hz



*Assembled in the USA using domestic and foreign parts

*EPA Certified Prime ratings are not available in the US or its Territories.

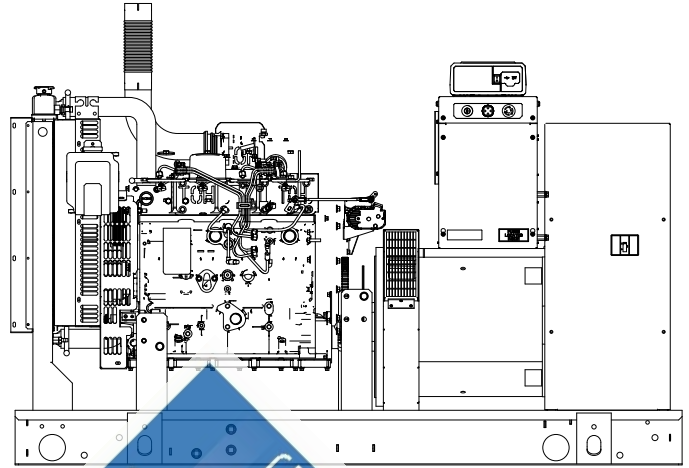


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Codes and Standards

Powering Ahead

Not all codes and standards apply to all configurations. Contact factory for details.



UL2200, UL6200, UL1236, UL489, UL142



CSA C22.2, ULC S601



BS5514 and DIN 6271



SAE J1349



NFPA 37, 70, 99, 110



NEC700, 701, 702, 708



NEMA ICS10, MG1, 250, ICS6, AB1



ANSI C62.41



IBC 2009, CBC 2010, IBC 2012, ASCE 7-05, ASCE 7-10, ICC-ES AC-156 (2012)



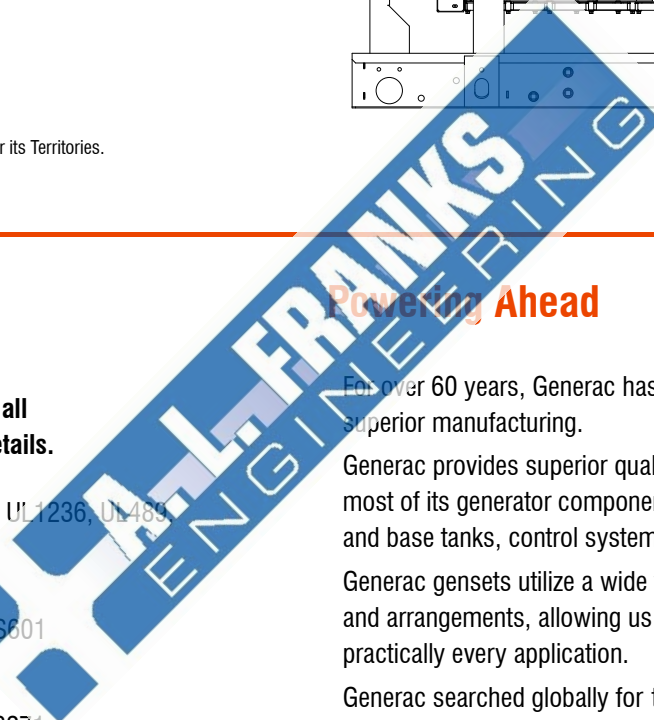
For over 60 years, Generac has provided innovative design and superior manufacturing.

Generac provides superior quality by designing and manufacturing most of its generator components, including alternators, enclosures and base tanks, control systems and communications software.

Generac gensets utilize a wide variety of options, configurations and arrangements, allowing us to meet the standby power needs of practically every application.

Generac searched globally for the most reliable engines to power our generators. We choose only engines that have already been proven in heavy-duty industrial applications under adverse conditions.

Generac is committed to ensuring our customers' service support continues after their generator purchase.



STANDARD FEATURES

ENGINE SYSTEM

- Engine Block Heater
- Oil Drain Extension
- Air Cleaner
- Level 1 Fan and Belt Guards (Open Set Only)
- Stainless Steel Flexible Exhaust Connection
- Factory Filled Oil and Coolant
- Radiator Duct Adapter (Open Set Only)
- Critical Silencer (Enclosed Only)

FUEL SYSTEM

- Fuel Lockoff Solenoid
- Primary Fuel Filter

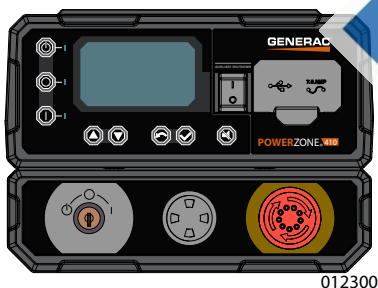
COOLING SYSTEM

- Closed Coolant Recovery System
- UV/Ozone Resistant Hoses
- Factory-Installed Radiator
- Radiator Drain Extension
- 50/50 Ethylene Glycol Antifreeze
- 120 VAC Coolant Heater

ELECTRICAL SYSTEM

- Battery Charging Alternator
- Battery Cables
- Battery Tray
- Rubber-Booted Engine Electrical Connections
- Solenoid Activated Starter Motor

CONTROL SYSTEM



Power Zone® 410 Controller

Features

- Programmable Auto Crank
- Selectable Low Speed Exercise
- RS-232 x2
- RS-485 x2
- All-Phase Sensing Digital Voltage Regulator
- On/Off/Manual Switch
- Not in Auto (Flashing Light)

ALTERNATOR SYSTEM

- UL2200 GENprotect™
- 12 Leads (3-Phase, Non 600V)
- Class H Insulation Material
- 2/3 Pitch
- Skewed Stator
- Auxiliary Voltage Regulator Power Winding
- Brushless Excitation
- Sealed Bearing
- Rotor Dynamically Spin Balanced
- Amortisseur Winding
- Full Load Capacity Alternator
- Protective Thermal Switch

GENERATOR SET

- Internal Genset Vibration Isolation
- Separation of Circuits - High/Low Voltage
- Separation of Circuits - Multiple Breakers
- Wrapped Exhaust Piping
- Standard Factory Testing
- 2 Year Limited Warranty (Standby Rated Units)
- 1 Year Limited Warranty (Prime Rated Units)
- Silencer Mounted in the Discharge Hood (Enclosed Unit Only)

- Emergency Stop
- Modbus® RTU
- CANbus
- Full Range Standby Operation
- Power Factor
- Ruptured Tank Detection
- Auxiliary Shutdown Switch
- Remote Communications
- NFPA110 Module Included (Key Switch, Alarm, E-Stop)
- I²T Function for Full Generator Protection (Contact Factory)

Full System Status Display

- Multilingual 128x64 Graphical Display with Heater
- Easy Status View LED Screen
- 3-Phase AC Volts
- 3-Phase Amps
- kW
- Line Power/Gen Power

ENCLOSURE (IF SELECTED)

- Rust-Proof Fasteners with Nylon Washers to Protect Finish
- High Performance Sound-Absorbing Material (Sound Attenuated Enclosures)
- Gasketed Doors
- Upward Facing Discharge Hoods (Radiator and Exhaust)
- Stainless Steel Lift Off Door Hinges
- Stainless Steel Lockable Handles
- RhinoCoat™ - Textured Polyester Powder Coat Paint

FUEL TANKS (IF SELECTED)

- UL 142, ULC S601
- Double Wall Construction
- Normal and Emergency Vents
- Sloped Top
- Sloped Bottom
- Factory Pressure Tested
- Rupture Basin Alarm
- Fuel Level
- Check Valve In Supply and Return Lines
- RhinoCoat™ - Textured Polyester Powder Coat Paint
- Stainless Steel Hardware

- Time
- Date
- Run Hours
- Service Reminders
- Fault History (Alarm Log)
- Oil Pressure
- Oil Temperature Indication and Alarm
- Output for Fuel Level High/Low Warning
- Water Temperature
- Water Level
- Fuel Pressure/Level
- Engine Speed
- Battery Voltage
- Alternator Frequency

Alarms and Warnings

- Common Alarm Output
- Audible Alarm and Silence

EPA Certified Stationary Emergency

CONFIGURABLE OPTIONS

ENGINE SYSTEM

- Oil Make-Up System
- Oil Heater
- Shipped Loose Industrial Silencer (Open Set Only)
- Radiator Stone Guard (Open Set Only)
- Level One Fan and Belt Guards (Enclosed Units Only)
- Air Filter Restriction Indication

FUEL SYSTEM

- Flexible Fuel Lines

ELECTRICAL SYSTEM

- 10A UL Listed Battery Charger
- Battery Warmer

ALTERNATOR SYSTEM

- Alternator Upsizing
- Anti-Condensation Heater
- Tropical Coating
- Permanent Magnet Excitation

GENERATOR SET

- 8 Position Load Center
- Extended Factory Testing

CIRCUIT BREAKER OPTIONS

- Main Line Circuit Breaker
- 2nd Main Line Circuit Breaker
- Shunt Trip Wand Auxiliary Contacts
- Electronic Trip Breakers

ENCLOSURE

- Level 0 Sound Attenuated
- Level 1 Sound Attenuated
- Level 2 Sound Attenuated
- Level 2 Sound Attenuated Enclosure (with Motorized Dampers)
- Steel Enclosure
- Aluminum Enclosure
- Up to 200 MPH Wind Load Rating (Contact Factory for Availability)
- AC/DC Enclosure Lighting Kit
- Door Open Alarm Horn
- Pad Vibration Isolators
- Enclosure Heater (with Motorized Dampers Only)
- IBC Seismic Certification

WARRANTY (STANDBY GENSETS ONLY)

- 2 Year Extended Limited Warranty
- 5 Year Extended Limited Warranty
- 7 Year Extended Limited Warranty
- 10 Year Extended Limited Warranty

CONTROL SYSTEM

- NFPA 110 Compliant 21-Light Remote Annunciator
- Remote Relay Assembly (8 or 16)
- Oil Temperature Indication and Alarm
- Remote E-Stop (Break Glass-Type, Surface Mount)
- Remote E-Stop (Red Mushroom-Type, Surface Mount)
- Remote E-Stop (Red Mushroom-Type, Flush Mount)
- E-Stop Terminal
- 10A Engine Run Relay
- Ground Fault Annunciator
- Damper Alarm Contacts (with Motorized Dampers Only)
- 20V GCFI and 240V Outlets
- 100 dB Alarm Horn

FUEL TANKS (SIZES ON LAST PAGE)

- 8 in (203.2 mm) Fill Extension
- 13 in (330.2 mm) Fill Extension
- Emergency Vents
- 12 ft Vent Extensions
- Overfill Protection Valve
- Fuel Drop Tube
- 5 Gallon Spill Box
- 5 Gallon Spill Box Return Hose
- Tank Risers
- Fuel Level Switch and Alarm
- Fire Rated Stainless Steel Fuel Hose
- 90% High Fuel Alarm
- Stainless Steel Fuel Lines

ENGINEERED OPTIONS

ENGINE SYSTEM

- Coolant Heater Ball Valves
- Fluid Containment Pan

CONTROL SYSTEM

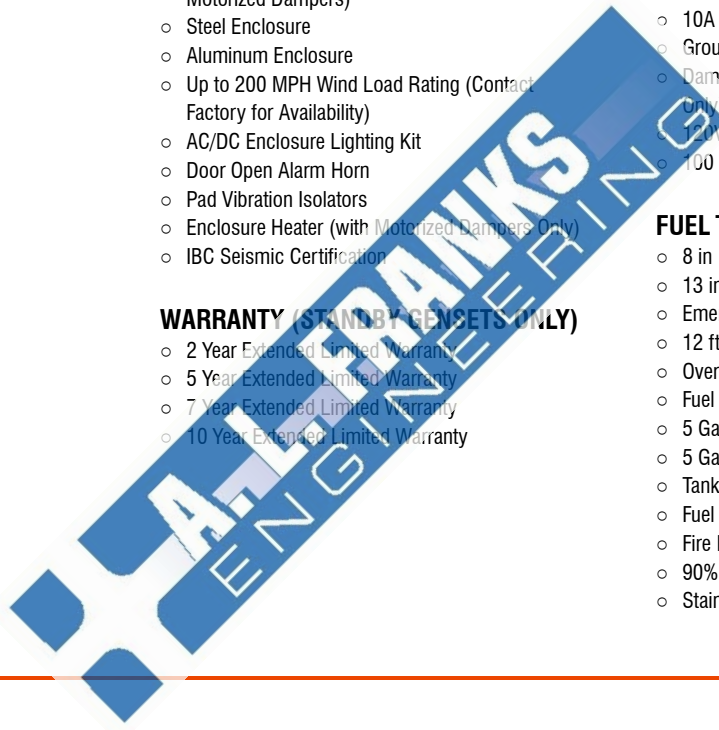
- Spare Inputs (x4) / Outputs (x4)
- Battery Disconnect Switch

ALTERNATOR SYSTEM

- 3rd Breaker System

FUEL TANKS

- UL 2085 Tank
- Stainless Steel Tanks



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APPLICATION AND ENGINEERING DATA

ENGINE SPECIFICATIONS

General

Make	Iveco/FPT
EPA Emissions Compliance	Stationary Emergency
EPA Emissions Reference	See Emission Data Sheet
Cylinder #	4
Type	In-Line
Displacement: in ³ (L)	274.6 (4.5)
Bore - in (mm)	4.1 (105)
Stroke - in (mm)	5.2 (132)
Compression Ratio	17.5:1
Intake Method	Turbocharged
Cylinder Head Type	2-Valve
Piston Type	Aluminum
Crankshaft Type	Forged Steel

Engine Governing

Governor	Electronic Isochronous
Frequency Regulation (Steady State)	±0.25%

Lubrication System

Oil Pump	Gear
Oil Filter Type	Full-Flow Cartridge
Engine Oil Capacity - qt (L)	14.4 (13.6)

Cooling System

Cooling System Type	Closed
Water Pump Type	Belt Driven Centrifugal
Fan Type	Pusher
Fan Speed - RPM	2,538
Fan Diameter - in (mm)	26 (660)

Fuel System

Fuel Type	Ultra Low Sulfur Diesel Fuel #2
Fuel Specifications	ASTM
Fuel Filtering (Microns)	5
Fuel Pump Type	Engine Driven Gear
Injector Type	Mechanical
Fuel Supply Line - in (mm)	0.5 (12.7) NPT
Fuel Return Line - in (mm)	0.5 (12.7) NPT

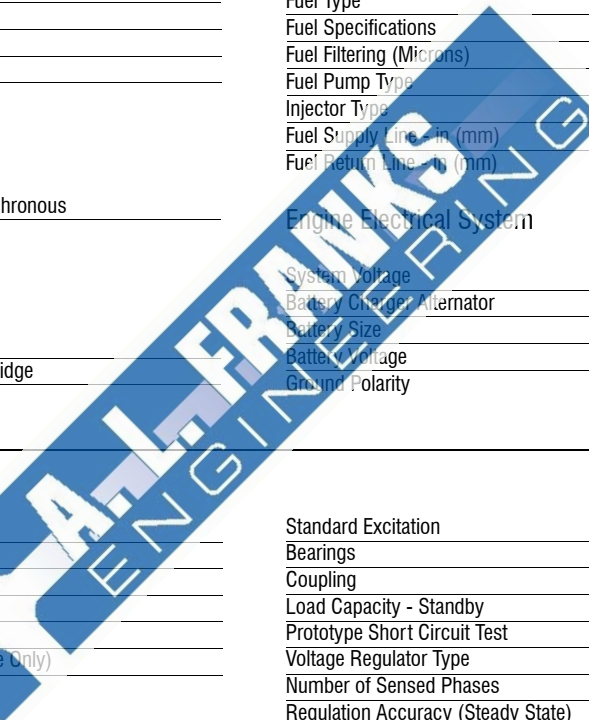
Engine Electrical System

System Voltage	12 VDC
Battery Charger Alternator	Standard
Battery Size	See Battery Index 0161970SBY
Battery Voltage	12 VDC
Ground Polarity	Negative (-)

ALTERNATOR SPECIFICATIONS

Standard Model	K0080124Y21
Poles	4
Field Type	Revolving
Insulation Class - Rotor	H
Insulation Class - Stator	H
Total Harmonic Distortion	<5% (3-Phase Only)
Telephone Interference Factor (TIF)	<50

Standard Excitation	Synchronous Brushless
Bearings	One, Pre-Lubed and Sealed
Coupling	Direct via Flexible Disc
Load Capacity - Standby	100%
Prototype Short Circuit Test	Yes
Voltage Regulator Type	Digital
Number of Sensed Phases	All
Regulation Accuracy (Steady State)	±0.25%



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OPERATING DATA

POWER RATINGS

		Standby
Single-Phase 120/240 VAC @1.0pf	80 kW	Amps: 333
Three-Phase 120/208 VAC @0.8pf	80 kW	Amps: 278
Three-Phase 120/240 VAC @0.8pf	80 kW	Amps: 241
Three-Phase 277/480 VAC @0.8pf	80 kW	Amps: 120
Three-Phase 346/600 VAC @0.8pf	80 kW	Amps: 96

MOTOR STARTING CAPABILITIES (skVA)

		skVA vs. Voltage Dip	
277/480 VAC	30%	277/480 VAC	30%
K0080124Y21	172	K0080124Y21	132
K0100124Y21	227	K0100124Y21	171
K0130124Y21	327	K0130124Y21	327

FUEL CONSUMPTION RATES*

Fuel Pump Lift - ft (m)	Diesel - gph (Lph)	
	Percent Load	Standby
3 (1)	25%	2.1 (7.9)
	50%	3.7 (14.0)
	75%	5.2 (19.7)
	100%	6.3 (23.8)
Total Fuel Pump Flow (Combustion + Return) - gph (Lph)		
13.6 (51.5)		

*Fuel supply installation must accommodate fuel consumption rates at 100% load.

COOLING

		Standby
Coolant Flow	gpm (Lpm)	32.7 (123.8)
Coolant System Capacity	gal (L)	4.5 (17.4)
Heat Rejection to Coolant	BTU/hr (kW)	232,270 (68.0)
Inlet Air	cfm (m³/min)	6,360 (180)
Maximum Operating Ambient Temperature	°F (°C)	122 (50)
Maximum Operating Ambient Temperature (Before Derate)	See Bulletin No. 0199280SSD	
Maximum Additional Radiator Backpressure	in H ₂ O (kPa)	0.5 (0.12)

COMBUSTION AIR REQUIREMENTS

	Standby
Flow at Rated Power - cfm (m³/min)	306 (8.7)

ENGINE

		Standby
Rated Engine Speed	RPM	1,800
Horsepower at Rated kW**	hp	131
Piston Speed	ft/min (m/min)	1,559 (475)
BMEP	psi (kPa)	210 (1,448)

**Refer to "Emissions Data Sheet" for maximum bHP for EPA and SCAQMD permitting purposes.

EXHAUST

		Standby
Exhaust Flow (Rated Output)	cfm (m³/min)	790 (22.4)
Maximum Allowable Backpressure (Post Silencer)	inHg (kPa)	1.5 (5.1)
Exhaust Temperature (Rated Output)	°F (°C)	887 (475)

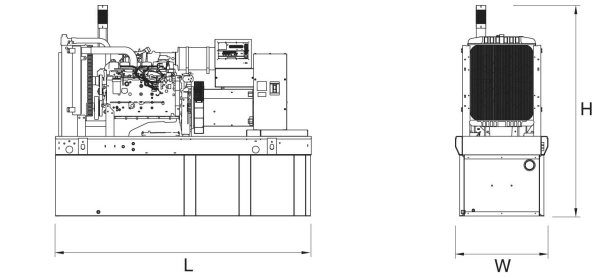
Deration – Operational characteristics consider maximum ambient conditions. Derate factors may apply under atypical site conditions. Please contact a Generac Power Systems Industrial Dealer for additional details. All performance ratings in accordance with BS5514 and DIN6271 standards.

Standby - See Bulletin 0187500SSB

Prime - See Bulletin 0187510SSB

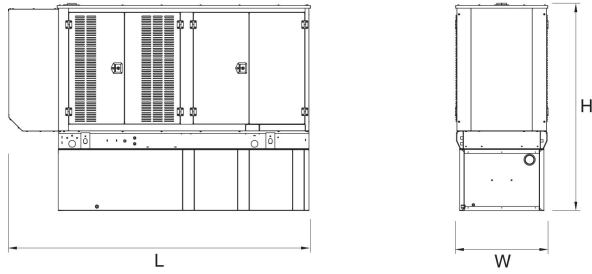
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DIMENSIONS AND WEIGHTS*



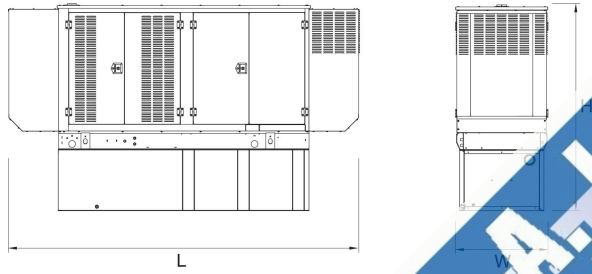
OPEN SET

Run Time - Hours	Usable Capacity - gal (L)	L x W x H - in (mm)	Weight - lbs (kg)
No Tank	-	93 (2,362) x 40 (1,016) x 49 (1,245)	2,425 (1,100)
13	79 (299)	93 (2,362) x 40 (1,016) x 62 (1,575)	2,947 (1,201)
30	189 (716)	93 (2,362) x 40 (1,016) x 74 (1,880)	3,183 (1,444)
48	300 (1,336)	93 (2,362) x 40 (1,016) x 86 (2,184)	3,407 (1,545)
56	350 (1,325)	110 (2,794) x 40 (1,016) x 86 (2,184)	Contact Factory
81	510 (1,931)	117 (2,972) x 47 (1,194) x 86 (2,184)	3,790 (1,719)
93	589 (2,230)	128 (3,251) x 49 (1,245) x 86 (2,184)	4,269 (1,936)



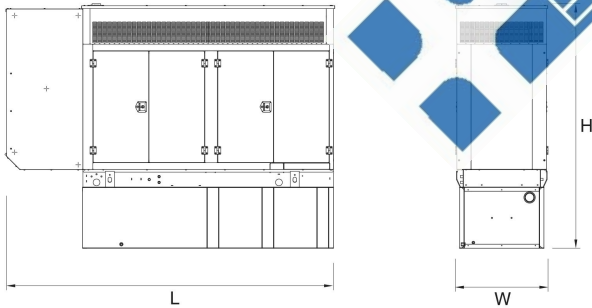
LEVEL 0 SOUND ATTENUATED ENCLOSURE

Run Time - Hours	Usable Capacity - Gal (L)	L x W x H - in (mm)	Weight - lbs (kg) Enclosure Only	
			Steel	Aluminum
No Tank	-	112 (2,845) x 41 (1,041) x 56 (1,422)		
13	79 (299)	112 (2,845) x 41 (1,041) x 69 (1,753)		
30	189 (716)	112 (2,845) x 41 (1,041) x 81 (2,057)	425 (193)	155 (70)
48	300 (1,336)	112 (2,845) x 41 (1,041) x 93 (2,362)		
56	350 (1,325)	112 (2,845) x 41 (1,041) x 93 (2,362)		
81	510 (1,931)	117 (2,972) x 47 (1,194) x 93 (2,362)		
93	589 (2,230)	128 (3,251) x 49 (1,245) x 93 (2,362)		



LEVEL 1 SOUND ATTENUATED ENCLOSURE

Run Time - Hours	Usable Capacity - Gal (L)	L x W x H - in (mm)	Weight - lbs (kg) Enclosure Only	
			Steel	Aluminum
No Tank	-	130 (3,302) x 41 (1,041) x 56 (1,422)		
13	79 (299)	130 (3,302) x 41 (1,041) x 69 (1,753)		
30	189 (716)	130 (3,302) x 41 (1,041) x 81 (2,057)	450 (204)	285 (129)
48	300 (1,336)	130 (3,302) x 41 (1,041) x 93 (2,362)		
56	350 (1,325)	130 (3,302) x 41 (1,041) x 93 (2,362)		
81	510 (1,931)	130 (3,302) x 47 (1,194) x 93 (2,362)		
93	589 (2,230)	130 (3,302) x 49 (1,245) x 93 (2,362)		



LEVEL 2 SOUND ATTENUATED ENCLOSURE

Run Time - Hours	Usable Capacity - Gal (L)	L x W x H - in (mm)	Weight - lbs (kg) Enclosure Only	
			Steel	Aluminum
No Tank	-	112 (2,845) x 41 (1,041) x 69 (1,753)		
13	79 (299)	112 (2,845) x 41 (1,041) x 82 (2,083)		
30	189 (716)	112 (2,845) x 41 (1,041) x 94 (2,388)	625 (284)	395 (180)
48	300 (1,336)	112 (2,845) x 41 (1,041) x 106 (2,692)		
56	350 (1,325)	112 (2,845) x 41 (1,041) x 106 (2,692)		
81	510 (1,931)	117 (2,972) x 47 (1,194) x 106 (2,692)		
93	589 (2,230)	128 (3,251) x 49 (1,245) x 106 (2,692)		

* All measurements are approximate and for estimation purposes only. Specification characteristics may change without notice. Please contact a Generac Power Systems Industrial Dealer for detailed installation drawings. Extended and not extended tank offerings vary. Contact dealer for options.

E SECTION 16000

ELECTRICAL

PART 1 - GENERAL

1.1 SCOPE:

- A. Furnish all labor, materials, transportation, and supervision to install a complete electrical system as shown on the drawings and as described herein. The electrical system shall be in perfect working order before being accepted by the owner.
- B. General and Special Conditions of these specifications are applicable in full.

1.2 WORK UNDER OTHER SECTIONS:

- A. Finished painting of conduits, equipment, etc., (except wood backboards), furnishing and installation of all motors, controls, and control circuits (except that all control devices in power circuits are to be installed under this section).

1.3 CODES, PERMITS AND INSPECTIONS:

- A. Comply with applicable laws of the community and with the latest edition of NEC where not in conflict with those laws. Obtain and pay for all permits required. After completion of the work, submit certificate of final inspection and approval from the local Electrical Inspector, certifying that the installation complies with all regulations governing the same. Make change to drawings and specifications required by code at no additional cost to the Owner.

1.4 MATERIALS AND WORKMANSHIP:

- A. All materials shall be new, UL approved where a standard has been established. Execute all work in a workmanlike manner so as to present a neat and mechanical appearance when completed.

1.5 DRAWINGS AND SPECIFICATIONS:

- A. Consider as complimentary each to the other. What is called for by one shall be as binding as if called for by both. Where conflicts occur, secure clarifications from Engineer prior to bidding; otherwise, provide the more expensive quality or quantity. Follow figures in preference to scale dimensions; verify all dimensions and existing conditions.

1.6 COORDINATION:

- A. Coordinate work so as to conform to the progress of the work of the other trades, and complete the entire installation as soon as the condition of the building permits. Phasing of work is specified previously in other sections.

1.7 CUTTING AND PATCHING:

- A. Where possible, all work shall be built in as the job progresses. Where this is not possible, secure approval, and do necessary cutting, chasing, etc., required. Repairing of surfaces cut shall be carefully done by skilled mechanics of the trade involved.

1.8 TESTING:

- A. Upon completion of the work, conduct a thorough test in the Engineer's presence, and show the entire system to be in perfect working condition.
- B. The Contractor performing the Electrical work shall coordinate all electrical work to provide complete, properly tested, adjusted and balanced mechanical systems throughout the project. He shall furnish progress reports on a regular basis as directed. He shall certify in writing when each system is electrically operable, including the check for proper rotation of equipment.

1.9 VISIT TO SITE:

- A. Before submitting a bid, visit the site and ascertain all existing conditions. Make such adjustments to work as required by the actual conditions encountered. Adjust routing of underground feeders for existing conditions.

1.10 MANUFACTURER'S DRAWINGS AND DATA:

- A. Submit for approval within 20 days of award of all items indicated below (5 copies). Because items must be coordinated one with another, partial submittals will not be considered. Submit a complete list of materials proposed; include all items, even if exactly as specified. Submit manufacturer's data (and samples upon request) for all items where substitutions are desired. Submit shop drawings for the panelboards and light fixtures (including those exactly as specified).
 1. Devices
 2. Light Fixtures
 3. Panelboards

PART 2 - PRODUCTS

2.1 CONDUCTORS:

Solid type THWN or THHN for No. 10 and smaller. Stranded type THW for No. 8 and larger; Rome, Triangle, Habirshaw, General, or equal.

2.2 CONDUIT, RIGID STEEL GALVANIZED AND FLEXIBLE STEEL:

Pittsburgh, Republic, General Electric, Youngstown, Triangle, or equal.

2.3 CONNECTORS:

For No. 10 and smaller conductors, use solderless type connectors, Ideal "Wing-Nut" Buchanan "B-Cap", or equal. For larger conductors use T&B "Lock-Tite" connectors, or equal, taped to original insulation valve.

2.4 ELECTRICAL METALLIC TUBING:

Pittsburgh, Republic, Youngstown, Triangle or approved equal.

2.5 FITTINGS, RIGID GALVANIZED CONDUIT:

Threaded type by Appleton, Crouse-Hinds, Russell & Stoll, Killark, or equal.

2.6 FITTINGS, E.M.T.:

Set screw type or Steel, compression type by Thomas & Betts, Tomic, Steel City, Appleton, or equal.

2.7 OUTLET BOXES:

Appleton, Steel City, Russell & Stoll, Raco, Crouse-Hinds, or equal.

PART 3 - EXECUTION

3.1 SERVICE

A. General:

Coordinate with owner. Provide all material and labor not supplied by Owner so as to produce a complete installation meeting the owner's regulations.

3.2 GROUNDING

A. General:

Ground the conductor and various conductive materials in the building per NEC Article 250.

B. Common Ground Conductor:

Connect to the existing grounding system.

C. Electric System (Neutral) Ground:

The current carrying neutral leg of the wiring system shall be of insulated conductor, and shall be connected to the common ground conductor only via the neutral connection at the service equipment.

D. Building Equipment Ground:

All non-current carrying metal parts of the wiring system (including conduit, outlet boxes, cabinets, motor frames, etc.) shall be connected to ground via the metallic conduit system. A grounding conductor (copper with green insulation, except where bare copper is used) shall be installed in each circuit and sized according to N.E.C. 250 Table 250.95. Provide bonding jumpers at flexible conduit connections, expansion joints, service equipment, enclosures, and all other places where required for electrical continuity.

3.3 POWER DISTRIBUTION SYSTEM

A. Types of Wiring:

Install wiring in a conduit raceway with conductors of the types and sizes as shown and specified herein, or where no types or sizes are shown, as required by Code.

B. Feeder Circuits:

Provide a complete system of wiring from main service equipment to the various panels and other locations as indicated.

C. Branch Circuits:

From panels extend a complete system of wiring to all fixtures, motors, devices and other equipment. Employ multi-wire circuits as indicated. Connect circuits to panelboards to give an evenly balanced load to the supplying feeder, based on normal usage of the connected equipment, and to assure that not more than one "phase" conductor of the multi-conductor circuit is connected to a single phase in the panelboard to cause overloading of the neutral conductor of the circuit. Lighting circuits shall supply lighting outlets only, except as shown. Secure approval of any departure from circuit arrangement as shown.

D. Indication on Drawings:

Numerals shown on "home runs" and by the outlet indicate the circuit arrangement, but this is not intended to show the exact connection to the numbered circuits in the panelboard. Cross marks on branch circuit runs indicate the numbers of conductors required. Where no cross marks are shown, two conductors are indicated.

3.4 RACEWAYS AND FITTINGS

A. Application:

Rigid galvanized conduit shall be used in all concrete or masonry solid structure, and in locations subject to moisture. Electrical metallic tubing (2 inches and smaller) may be used in other portions of the structure (above furred ceilings, exposed, etc.). PVC conduit may be used underground where not subject to physical damage. Rigid metal risers shall be used with PVC conduit.

B. Conduit Sizes:

Comply with NEC, Chapter 9; minimum 3/4 inch.

C. Layouts:

Install all conduit concealed, except as in equipment rooms and where exposed runs are specifically indicated. Keep runs at least 12 inches from flues, hot water pipes, and other heat sources. Eliminate trapped runs insofar as possible. Do not chase new work, but instead build in conduit as work progresses. Do not run conduit in cavity of exterior wall. Generally, follow the conduit layout shown on the drawings; however, the layout is diagrammatic only, and must be adjusted for structural conditions, built-in equipment and other causes. Offsets are not indicated, and must be furnished as required. Run concealed conduits in direct line with long sweep bends and offsets where practicable.

D. Installation:

Securely fasten conduits to all sheet metal outlets, cabinets, junction and pull boxes with locknuts and bushings, taking care to see that stout mechanical and solid electrical connections are obtained. Thread rigid conduit so that ends meet in couplings, cut ends square, ream smooth, and draw up tight. Cap conduit ends to keep out water and trash during construction. Avoid field-made bends wherever possible, but where necessary, use a proper hickey or conduit-bending machine. Make no bends with radius less than six times the conduit diameter, nor more than 90 degrees. Make change in direction with pull boxes, symmetrical bends, and cast-metal fittings. Replace crushed and deformed conduits.

E. Support by Anchoring:

All conduits, concealed or exposed, shall be supported and substantially fastened to structural members at intervals of not more than 8 feet. Support with approved types of galvanized wall brackets, ceiling trapeze, strap hangers, or pipe straps. Attach supporting devices with screws, bolts, expansion sleeves or other workmanlike means appropriate to the surface.

F. Empty Conduit:

Provide No. 14 galvanized fish wire with 14-inch free ends.

G. Terminated Conduit:

Provide bushings on ends where auxiliary system conduit raceway is stubbed out into a furred space, adjacent to backboard, etc.

H. Pull Boxes:

Galvanized sheet metal screw-cover type. Provide as required to avoid excessive runs or bends between outlets. Coordinate pull box location with Engineer.

3.5 OUTLET BOXES

A. General:

Except as noted, boxes shall be standard galvanized or sheradized at least 1-1/2 inches deep, of metal at least 1/16 inch thick; sized to accommodate devices and conductors as per NEC Article 370. Coordinate depth with wall construction.

H. Locations:

The drawings indicate approximate locations only; determine the exact location at the building in view of all structural and architectural conditions. Obtain Engineer's verification of final location for all outlets.

1. Where outlets at different levels are shown adjacent, install in one vertical line where possible.

I. Mounting and Supports:

Boxes which are not embedded in masonry or concrete shall be fastened to the structure in the same manner specified for conduits.

3.6 CONDUCTORS

A. Material:

Copper with not less than 98% conductivity; 600-volt insulation; with manufacturer's name, type insulation and conductor size imprinted on jacket at regular intervals. Conductors pulled through fluorescent fixtures shall have insulation rated at 90 degrees C.

B. Sizes:

AWG sizes as noted. None smaller than No. 12. Where branch circuit runs exceed 100 feet in length, increase to next larger size.

C. Color Coding:

Follow NEC Section 210-5. Use white conductors only for neutral conductors. Where it is not practical to provide a white conductor as a neutral in a feeder, the conductor shall be identified in switches, panelboards, junction boxes and other fittings, with white tape or white paint. Equipment grounds shall be green.

D. Installation:

Do not pull conductors until all conduit systems are complete, and the building has been closed to weather. Use only UL approved lubricants to facilitate pulling of conductors.

3.7 WIRING DEVICES

A. General:

Manufacturer's and catalog numbers are used to establish style, type and quality. Equal devices by Eagle, Leviton, Hubbell, Bryant, Sierra, P & S, General Electric, Slater, and others will be accepted. All devices shall have plaster ears and grounding straps.

B. Device Plates:

Provide single plate of proper gang where more than one device occurs. Furnish blank plates on outlets for future use. At exposed conduit fittings or boxes employ galvanized steel utility box plates by box manufacturer.

C. Installation:

Unless otherwise noted, install wall devices vertically so that all devices of any given height will align exactly. Plates must be plumb and true with all four edges in continuous contact with the wall surface. Mount receptacles with grounding terminals down. Do not install devices until plastering or other type wall covering has been completed; install ahead of painting work, but protect it from paint splatter.

3.8 EQUIPMENT CONNECTIONS

A. General:

Provide electrical connections to all equipment furnished under this or other sections of these specifications, or by Owner. All equipment shall be connected ready for operation, in accordance with detail wiring diagrams, furnished by the equipment manufacturer and in cooperation with the respective subcontractor or Owner. Provide receptacles to match equipment furnished with plugs.

B. Connections:

Provide safety switches for all motors and equipment as indicated or required by Code. Safety switches shall be as heretofore specified. Connect all motors and equipment to equipment terminal boxes with flexible conduit with ground conductor. Where terminal boxes are not provided, terminate flexible conduit with suitable fittings and make connections. Provide cords, plugs, and receptacles where required for proper connection.

C. Motors and Motor Starters:

Furnishing and installation of motors is specified under various sections. Connect for correct rotation. Starters are specified to be furnished with motors but shall be installed and connected by the Electrical Contractor.

3.11 MISCELLANEOUS ITEMS

A. Nameplates:

Provide 1" x 2" laminated phenolic nameplates (with 1/4-inch high white letters on black) on disconnect switches, panels. Apply with stainless steel self tapping screws.

END OF SECTION 16000

SECTION 16010
GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

The scope of the electrical phase of this project shall include all labor, materials, equipment, etc, required to fulfill the intent of the Contract Documents and shall include the work specified under the following sections:

SECTION 16050 - BASIC MATERIALS AND METHODS
SECTION 16400 - SERVICE AND DISTRIBUTION

1.2 RELATED DOCUMENTS

All applicable provisions of Division 0 and 1 govern work under this division. Refer to these articles in the specifications for additional information.

1.3 REFERENCE STANDARDS

- A. All work shall be performed in accordance with the latest editions of the applicable state, national, and local ordinance and building codes and in accordance with the National Electric Code.
- B. Refer to each section for applicable codes and reference standards.

1.4 FEES, PERMITS AND TAXES

- A. This contractor shall make arrangements for and pay for all inspection fees and permits required by the local authorities. The Contractor shall also pay all taxes levied for labor and materials associated with work under this Division.

1.5 SUBMITTALS

- A. Submittals shall be presented from published manufacturer's data and in such a form that the Engineer can readily verify compliance with codes, standards, and the Contract Documents including construction features rough-in requirements, etc. Each submittal shall contain data relevant to the particular equipment (including options) being submitted on. The data shall be identified by "highlighting", arrows, underlining, etc. Do not submit pages of non-relevant information. Broad general data is not acceptable. If equipment submitted on is not as specified in the Contract Documents, then the submittal shall contain specific details prominently displayed identifying any differences in form, fit, or function.

1.6 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

- A. Each operating and maintenance manual shall apply specifically to the equipment installed and provided. In those cases where one manual covers a general class of equipment, the contractor shall be required to identify (by highlighting, underlining, etc.) those portions which apply to the installed equipment. All operating and maintenance manuals shall be available for inspection by

the Engineer at the final inspection.

- B. Provide (2) two copies of operating and maintenance manuals. Manuals shall be bound in large ring loose-leaf binders and contain the following:
 - 1. Manufacturer's instructions an/or installation manual.
 - 2. See Division 1 for further operating and maintenance manual requirements.

1.7 **PRIOR APPROVAL**

- A. Where the contractor wishes to substitute equipment or materials under to "or equal" clause, he shall submit to the Engineer in writing ten (10) calendar days prior to bid opening, lists of proposed substitutions which, from published manufacturer's data, cover the salient features of the proposed substitution. Approvals will be issued in writing.

1.8 **GUARANTEE**

- A. This contractor shall guarantee fully all workmanship, material, equipment, systems, etc., provided by him for a period of one year after substantial completion of the project. This guarantee means that this contractor shall make good to the owner, at no cost, any defects that become apparent during the year following substantial completion. This guarantee is in addition to any other guarantees or warranties and is not intended to limit such other guarantees or warranties.

1.9 **DEFINITIONS**

The following words and phases as used herein are hereby defined:

- A. "Provide": Furnish and install all material and labor required for a complete installation ready for operation in accordance with the intent of the Contract Documents.
- B. "As Required": Indicated that the contractor shall perform the work or provide the material as indicated in accordance with manufacturer's installation instructions; and in accordance with applicable codes or regulations.
- C. "Or Equal": Indicates that the contractor may substitute equipment by another manufacturer if the salient features of the equipment indicated by manufacturer's name and/or described are, in the judgment of the Engineer, adequate. See article PRIOR APPROVAL.
- D. "Contractor": Where the word(s) "contractor" or "this contractor" is used herein it refers to the contractor engaged to execute the work under this division of the specifications only, even though he may be technically described as a sub-contractor.
- E. "Intent of the Contract Documents": The specific intent of these documents is to provide to the owner, in a thoroughly functional condition, all the various systems, equipment, etc., indicated herein. Final authority over interpretation of the "intent" shall rest with the Engineer.
- F. "Shall": Indicates a mandatory requirement.

1.10 **INSPECTION OF THE SITE**

- A. The drawings are prepared from the best information available and reflect all conditions

commensurate with this information. However, the contractor shall visit the site prior to submitting a proposal and shall verify the locations, sizes, depths, pressures, etc., of all existing utilities and familiarize himself with working conditions, hazards, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, the Engineer shall be notified in writing.

- B. All proposals shall take these existing conditions and any revisions required into effect, and the lack of specific site information on the drawings shall not relieve the contractor of any responsibility.

1.11 CONSTRUCTION SAFETY

- A. This contractor assumes all responsibility regarding the safety of his personnel on the project during construction. The Contract Documents do not include materials, procedures, components, etc., required to insure construction safety. Refer to General Conditions and Supplementary General Conditions for additional information.

1.12 DAMAGE

- A. This contractor shall be responsible for damage to the project caused by this contractor's failure to recognize hazards associated with items such as leaks, scheduling of work (tardiness), inexperienced workmen, excessive cutting, etc.
- B. This contractor shall repair at no expense to the owner any such damage.
- C. This contractor shall familiarize himself with working conditions to the extent that he shall be responsible for damage to concealed piping, wiring, and other equipment meant to remain and shall repair any damage caused by his negligence at no cost to the owner.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.1 WORKMANSHIP

- A. All work shall be done by experienced craftsmen skilled in the applicable trade.
- B. Unprofessional and incomplete work shall be rejected and corrected at no additional expense.
- C. The Contractor performing the Electrical work shall coordinate all electrical work to provide complete, properly tested, adjusted and balanced mechanical systems throughout the project. He shall furnish progress reports on a regular basis as directed. He shall certify in writing when each system is electrically operable, including the check for proper rotation of equipment.

3.2 MANUFACTURER'S INSTALLATION INSTRUCTIONS

All equipment shall installed in strict compliance with manufacturer's installation instructions.

3.3 PROTECTION OF EQUIPMENT

The contractor shall continuously maintain adequate protection of stored material and installed equipment. Fixtures and equipment located inside or outside shall be tightly covered with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust, moisture, and abuse from other trades. Adequate air circulation shall be provided under any protective sheeting to prevent condensation build up. Materials and equipment shall not be stored directly on the ground. Ductwork, piping and equipment shall not be used by other trades as supports for scaffolds or personnel. At the completion of the work, equipment, fixtures, exposed supports, and piping shall be cleaned of loose dirt, construction debris, overspray, etc., to the satisfaction of the Engineer. Repairs made necessary by damage shall be paid for by the contractor.

3.4 CONFLICTS, INTERFERENCES, AND COORDINATION BETWEEN TRADES

- A. The drawings are not to be construed as shop drawings, but indicate the extent, general location, arrangement, etc., of conduit systems and equipment. If the contractor has any question regarding the layout of a particular device or equipment item he shall contact the Engineer for clarification. This is particularly true of layouts with a repetitive theme. Inasmuch, this contractor shall, in laying out his work, refer to other sections of the specifications and other drawings such as air conditioning, electrical, structural, architectural, etc., in order to eliminate conflicts and undue delays in the progress of the work. See article CUTTING AND PATCHING for additional coordination required. Where other contractors furnish items requiring piping connections by this contractor, they will be held responsible for providing rough-in drawings and assistance upon request.
- B. In the event of interferences, piping or equipment requiring set grades or elevations, shall have precedence over conduit, lighting, outlet boxes, air conditioning, ductwork, etc.
- C. In the event of conflicts between specifications and drawings, drawings shall take precedence over specifications except in matters pertaining to quality, applications and coordination between trades, which shall be governed by specifications.
- D. In the event of conflict between codes as interpreted by the authority having jurisdiction, and the contract documents, the codes shall govern.
- E. In the event of conflict between manufacturer's installation instructions and the drawings, the manufacturer's installation instructions shall govern.
- F. In all events, the intent of the Contract Documents shall govern. Minor conflicts and interferences shall wherever possible be worked out on the project. Major conflicts shall be referred to the Engineer for solution.

3.5 CUTTING AND PATCHING

- A. All cutting required by the installation of sleeves, piping, equipment, etc., shall be coordinated with the General Contractor, but performed by this contractor. Patching shall be by the General

Contractor. This contractor shall not cut any structural element or any finished work without written permission from the Engineer.

3.6 PAINTING

- A. All painting except "touch up" shall be provided under the painting section (Division 9) unless noted otherwise. All exposed piping, equipment etc., shall be left clean and free from rust or grease and ready for the painter.
- B. Where equipment finishes are damaged this contractor shall obtain touch up paint in matching colors from the equipment manufacturer and paint as required.

3.7 EQUIPMENT CONNECTIONS

- A. This contractor shall bring all required services to all equipment items furnished under other sections of this specification or by the owner, make final connections, and leave equipment ready for operation. This contractor shall coordinate with an affected trade to insure correct operations of the equipment item i.e., phase rotation, switching, control location, and accessibility.
- B. When the contractor is uncertain about the method of installation, proper location, etc, he shall ask for further instructions or details. Failure to request such information will not excuse non-compliance.

3.8 TESTS

- A. All tests of the electrical system shall be made by this contractor and repeated until approved by the Engineer. Conduit systems shall not be covered or otherwise concealed until tests have been made and approvals obtained. Notify the Engineer four days prior to tests to allow for scheduling.

3.9 CLEAN-UP

- A. When all work has been finally tested, this contractor shall clean all work installed by him, including all fixtures, equipment, and all exposed work.

3.10 DEMOLITION AND SALVAGE

- A. Where demolition of equipment or materials is required this contractor shall minimize cutting and exercise all due caution to leave undamaged surfaces, material, and equipment meant to remain.
- B. All existing items that are to be removed shall remain property of the owner unless declared as salvage. Salvage materials shall become property of the contractor and removed from the site. Items declared as owner's property shall be neatly stored on the site as directed by the owner.
- C. Existing electrical equipment (except cast-in-place conduit) such as wiring devices, lighting fixtures, junction boxes, etc., are to be removed from the job.

END OF SECTION 16010

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SCOPE

- A. Work of this section shall include specification of electrical devices to be used in subsequent sections and shall include the following principal items:

1.2 RELATED WORK

SECTION 16400 - SERVICE AND DISTRIBUTION

1.3 REFERENCED STANDARDS

NFPA 70 - National Electrical Code

NFPA 101 - Life Safety Code

ANSI C2 - National Electrical Safety Code

ANSI 05.1-1972 - American National Standard Specifications and Dimensions

AWPA C1-8 - American Wood-Preservers Association Standard

PART 2 - PRODUCTS

2.1 RACEWAYS

- A. All wiring indicated including power wiring, emergency systems wiring (NEC Article 700), temperature control wiring, communication wiring where indicated, etc., shall be in separate raceways.
- B. Galvanized Rigid Steel conduit (CRS) or intermediate metal conduit (IMC) shall be galvanized (inside and outside) steel and shall be used for applications underground, under slab, underfloor or "cast-in" concrete, or exposed on exterior. Connectors and couplings shall be threaded type only.
- C. Electrical metallic tubing (EMT) shall be galvanized steel and shall be used for all concealed or exposed work above the floor unless noted otherwise. Connectors and couplings shall be threadless compression type.
- D. Flexible metal conduit may be used for final connections to recessed lighting fixtures and shall be used for final connections to motors.
- E. Liquidtight flexible metal conduit shall be used in wet locations for final connections to motors and other equipment subject to vibration.

2.2 WIRES AND CABLES (600 VOLTS AND LESS)

- A. Provide all wiring as indicated and/or required to each piece of equipment, wiring device, lighting fixture, etc.
- B. All wire sizes specified here and elsewhere shall be in accordance with and designated by AWG (American Wire Gauge).
- C. Copper conductors equal to Anaconda, Phelps-Dodge, Southwire or General Electric shall be used throughout. The design is based on copper conductors.
- D. Insulation for power conductors shall be type THW or THHN, rated 600 volts. Branch circuit conductors sizes #6 AWG and smaller, may be type TW. Insulation shall be color coded as required by the N.E.C. and as specified below. For conductors wired in fluorescent fixture runs use type RHH or THHN insulation.
- E. Copper clad conductors are not permitted.
- F. Color coding of conductor insulation shall be uniform throughout the project, in accordance with the following table.

	<u>120/240 volts</u>	<u>240/120 volts</u>
Phase A	Black	Black
Phase B		Red
Phase C	Blue	Blue
Neutral	White	White
Ground	Green	Green

No other colors to be used for branch circuits. Main feeders may be taped or painted at panelboard terminations. From left to right, the first bus in each panel shall be phase "A", middle "B", and right bus "C".

2.3 OUTLET AND JUNCTION BOXES

- A. Provide metallic galvanized boxes per the N.E.C. Article 370 at each outlet location indicated on the drawings or as required.
- B. The owner reserves the right to make minor adjustments to the location of outlet boxes prior to rough-in.
- C. Sizes and configuration of boxes shall be as required for the intended service and shall conform to and be applied in accordance with Table 370-6(a) of the N.E.C. Provide extension rings, expandable bar sets, supports, gaskets for weatherproof type etc., where required.
- D. Gang type boxes shall be used where multiple wiring devices are adjacent to one another.

2.4 DEVICE PLATES

- A. Provide a brushed finish formula 302 stainless steel device plate (brown plastic plates at wood paneled walls) with matching screws for each flush mounted wiring device, blank box, telephone

outlet, etc., as required. Plates shall completely cover rough wall opening (use oversized plates if required) and shall have rounded edges.

- B. Plates on surface mounted boxes not used in conjunction with surface metal raceway system shall be galvanized steel with 1/2" raised face and rounded edges.
- C. Single multi-gang device plates shall be used where multiple devices occur.
- D. Sectionalized plates will not be acceptable.
- E. Acceptable manufacturers: Bell, Hubbell, P & S, Perfectline.

PART 3 - EXECUTION

3.1 RACEWAYS

- A. Raceways shall be installed neatly racked, routed parallel or perpendicular to building lines, securely attached and supported. Installation shall conform with applicable sections of N.E.C. Articles 345 through 351.
- B. Concealed raceway shall be supported with #17 AWG annealed black steel wire (minimum 2 laps) secured to structure. Conduit shall not be used to support other conduit. Exposed raceways shall be secured to structure with galvanized stamped steel clamps or suspended from structure with beam clamps and conduit hangers.

Grouped raceways shall be supported with galvanized steel channel assemblies equal to Kindorf B-909 and single-bolt straps equal to Kindorf C-105. Acceptable manufacturers: Unistrut, Power Strut, Globe Strut.

Raceway supports shall be spaced as follows:

1. GRS, IMC or EMT - within 3' of termination/connection and 10' o.c.
- C. Raceways shall be concealed where possible in finished areas, and may be exposed in mechanical/electrical equipment rooms.
 - D. Provide expansion fittings in all conduits crossing an expansion joint. Fitting shall be O.Z. type "EX" for rigid metal conduit, IMC or Schedule 40 PVC, and O.Z. type "TX" for EMT. Metallic conduit not containing a grounding conductor shall have O.Z. type "BJ" bonding jumpers installed across expansion joints.

Acceptable manufacturers: Burndy, ITT Blackburn, Thomas & Betts, Anderson.

- E. Pull boxes shall be provided as required for long runs and where excessive turns are encountered.
- F. Grade all raceways away from the service entrance equipment to prevent water damage.
- G. Homeruns shall be 3/4" minimum.

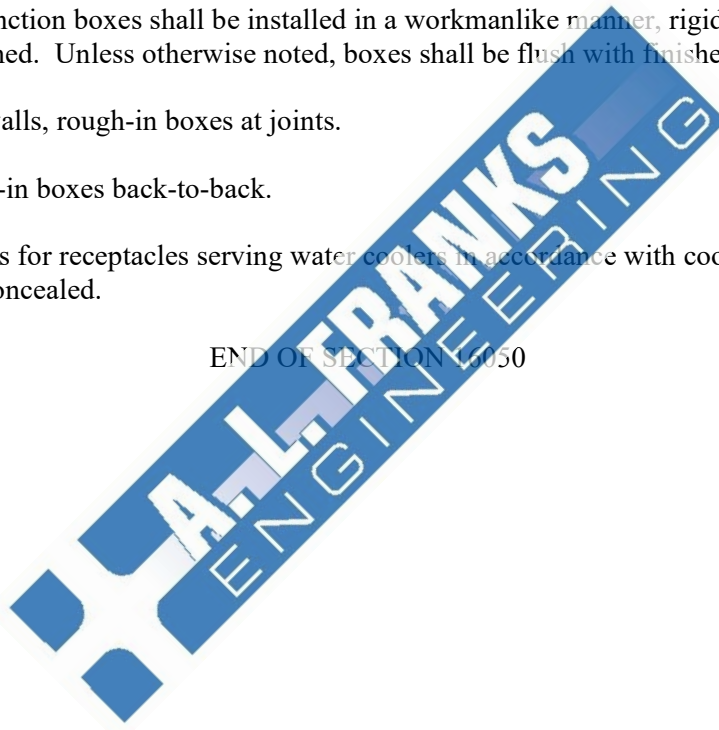
3.2 WIRES AND CABLES

- A. All splices, taps, connections, terminations, etc., shall be made with appropriate connectors in a workmanlike manner and in compliance with the N.E.C.
- B. All home runs shall be #12 or larger as indicated. Provide #10 where home runs exceed 60 feet in length. No wire smaller than #12 permitted serving lighting or outlets.
- C. Splices for any combination of stranded and/or solid copper wire up to 3#8 or 2#6 shall be made with solderless electrical spring connectors (Scotchlok) type. Splices for larger wire shall be solderless compression indentation type properly taped.
- D. Provide suitable split-wedge cable supporting devices in each conduit riser, as required to properly support vertical cables.

3.3 OUTLET AND JUNCTION BOXES

- A. Outlet and junction boxes shall be installed in a workmanlike manner, rigidly supported and properly aligned. Unless otherwise noted, boxes shall be flush with finished surfaces.
- B. In masonry walls, rough-in boxes at joints.
- C. Do not rough-in boxes back-to-back.
- D. Located boxes for receptacles serving water coolers in accordance with cooler rough-in data so that cord is concealed.

END OF SECTION 16050



SECTION 16400

SERVICE AND DISTRIBUTION

PART 1 - GENERAL

1.1 SCOPE

- A. Work of this section shall be in accordance with the intent of the Contract Documents and shall include the following principal items:

1.2 RELATED WORK

Section 16010 - GENERAL PROVISIONS
Section 16050 - BASIC MATERIALS AND METHODS

1.3 REFERENCED STANDARDS

NFPA 70 - National Electrical Code
NFPA 101 - Life Safety Code
ANSI C2 - National Electrical Code

PART 2 - PRODUCTS

2.1 ELECTRICAL DISTRIBUTION EQUIPMENT

- A. All power and lighting distribution equipment herein specified shall be by the same manufacturer. This includes switchboards, panelboards, motor control centers, bus duct, safety switches, lighting contactors, manual transfer switches and miscellaneous cabinets as applicable.
- B. All electrical distribution equipment shall be U.L. labeled. Model numbers indicated herein are based on Square D Company.
- C. Acceptable manufacturers: Square D, General Electric, Westinghouse, ITE.

2.2 MANUAL TRANSFER SWITCH

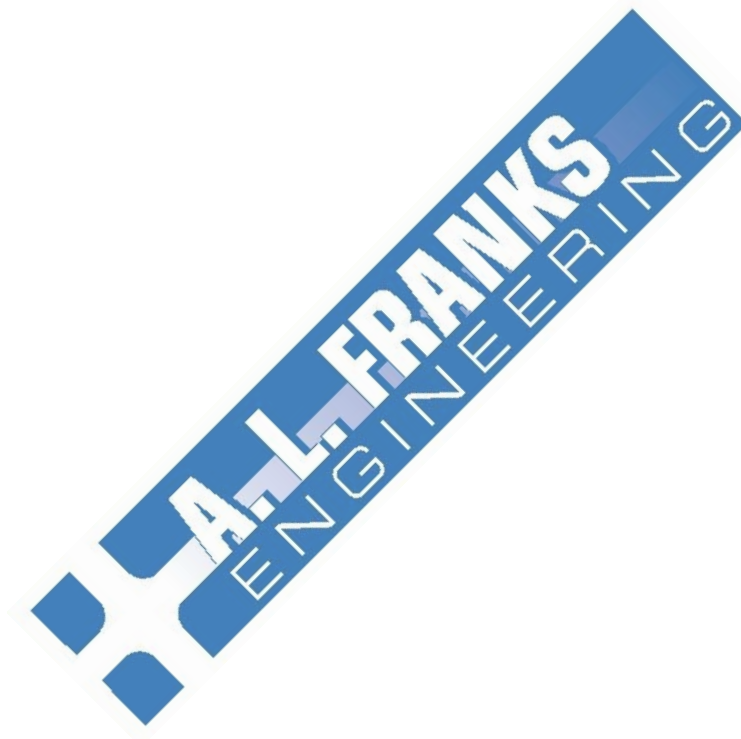
- A. Acceptable manufacturers: Square D, General Electric, Westinghouse, ITE.
- B. Cutler-Hammer Pow-R-Line switches are approved equals. All switches must meet the requirements of the latest National Electrical Code (NEC) and applicable UL and NEMA standards.
- C. Switches used as service entrance equipment shall be so labeled.
- D. An individual terminal or lug shall be provided for each neutral wire.

PART 3 - EXECUTION

3.1 **GROUNDING**

- A. Electrical grounding shall conform to Article 250 of the 2008 N.E.C. Neutral conductors, cable shields and sheaths, metallic conduits, junction boxes enclosures and all conductive non-current carrying parts of equipment shall be grounded.

END OF SECTION 16400



E SECTION 16500

ENGINE GENERATOR SPECIFICATION

1. General

1.1. Description of System & Sit

1.1.1. Provide a 60 kW integrated, standby power system to supply electrical power at 240Volts, 60 Hertz, 3 Phase with a 100 kW alternator. The generator shall consist of a liquid cooled diesel (bi-fuel configured) engine, a synchronous AC alternator, and system controls with all necessary accessories for a complete operating system, including but not limited to the items as specified hereinafter.

1.1.2. The site is an NEC ordinary location with no specific harsh environment requirements. The genset shall be applied at the listed ambient and elevation. Bidders to submit the generators rated power output at 100 ambient (°F) and 1000 elevation (Ft). Bidders are to submit the genset's sound level in dBA at 23 ft based on the configuration specified.

1.2. Requirements of Regulatory Agencies

1.2.1. An electric generating system, consisting of a prime mover, generator, governor, coupling and all controls, must have been tested, as a complete unit, on a representative engineering prototype model of the equipment to be sold.

1.2.2. The generator set must conform to applicable NFPA requirements.

1.2.3. The generator set must include a listing for the UL 2200 standard for stationary engine generator assembly.

1.2.4. The generator set must meet EPA federal emission guidelines for stationary emergency power generation.

1.3. Manufacturer Qualifications

1.3.1. This system shall be supplied by an original equipment manufacturer (OEM) who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of 25 years, thereby identifying one source of supply and responsibility. Approved suppliers are Generac Industrial Power or an approved equal.

1.3.2. The manufacturer shall have printed literature and brochures describing the standard series specified, not a one of a kind fabrication.

1.3.3. Manufacturer's authorized service representative shall meet the following criteria:

- 1.3.3.1. Certified, factory trained, industrial generator technicians
- 1.3.3.2. Service support 24/7
- 1.3.3.3. Service location within 200 miles
- 1.3.3.4. Response time of 4 hours
- 1.3.3.5. Service & repair parts in-stock at performance level of 95%

1.4. Submittals

- 1.4.1. Engine Generator specification sheet
- 1.4.2. Controls specification sheet(s)
- 1.4.3. Installation / Layout dimensional drawing
- 1.4.4. Wiring schematic
- 1.4.5. Sound data
- 1.4.6. Emission certification
- 1.4.7. Warranty statement

2. Engine

2.1. Engine Rating and Performance

2.1.1. The prime mover shall be a liquid cooled, diesel fueled, turbocharged after-cooled engine of 4-cycle design. It will have adequate horsepower to achieve rated kW output with at an operating speed of 1800 RPM.

The engine shall support a 100% load step.

2.1.3. The generator system shall support generator start-up and load transfer within 10 seconds.

2.2. Engine Oil System

2.2.1. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s).

2.2.2. The engine shall operate on mineral based oil. Synthetic oils shall not be required.

2.2.3. The oil shall be cooled by an oil cooler which is integrated into the engine system.

Engine Cooling System

2.3.1. The engine is to be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system. The coolant system shall include a coolant fill box which will provide visual means to determine if the system has adequate coolant level. The radiator shall be designed for operation in 122 degrees F, (50 degrees C) ambient temperature.

2.3.2. The engine shall have (a) unit mounted, thermostatically controlled water jacket heater(s) to aid in quick starting. The wattage shall be as recommended by the manufacturer.

2.3.3. Engine coolant and oil drain extensions, equipped with pipe plugs and shut-off valves, must be provided to the outside of the mounting base for cleaner and more convenient engine servicing.

2.3.4. A radiator fan guard must be installed for personnel safety that meets UL and OSHA safety requirements.

2.4. Engine Starting System

2.4.1. Starting shall be by a solenoid shift, DC starting system.

2.4.2. The engine's cranking batteries shall be lead acid. The batteries shall be sized per the manufacturer's recommendations. The batteries supplied shall meet NFPA 110 cranking requirements of 90 seconds of total crank time. Battery specifications (type, amp-hour rating, cold cranking amps) to be provided in the submittal.

2.4.3. The genset shall have an engine driven, battery charging alternator with integrated voltage regulation.

2.4.4. The genset shall have an automatic dual rate, float equalize, 10 amp battery charger. The charger must be protected against a reverse polarity connection. The chargers charging current shall be monitored within the generator controller to support remote monitoring and diagnostics. The battery charger is to be factory installed on the generator set. Due to line voltage drop concerns, a battery charger mounted in the transfer switch will be unacceptable.

2.5. Engine Fuel System

2.5.1. The engine fuel system shall be designed for operation on #2 diesel fuel and cold weather diesel blends.

2.5.2. The engine shall include a primary fuel filter, water separator, manual fuel priming pump, and engine flexible fuel lines must be installed at the point of manufacture. Element shall be replaceable paper type.

2.5.3. The engines suction line shall be fitted with a check valve to secure prime for the engines injection pump.

Engine Controls

2.6.1. Engines that are equipped with an electronic engine control module (ECM), shall monitor and control engine functionality and seamlessly integrate with the genset controller through digital communications. ECM monitored parameters shall be integrated into the genset controllers NFPA 110 alarm and warning requirements. All ECM fault codes shall be displayed at the genset controller in standard language – fault code numbers are not acceptable.

2.6.2. For engines without ECM functionality or for any additional genset controller monitoring, sensors are to be conditioned to a 4-20ma signal level to enhance noise immunity and all sensor connections shall be sealed to prevent corrosion.

2.6.3. Engine speed shall be controlled with an integrated isochronous governor function with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.

2.7. Engine Exhaust & Intake

2.7.1. The engine exhaust emissions shall meet the EPA emission requirements for standby power generation.

2.7.2. The manufacturer shall supply its recommended stainless steel, flexible connector to couple the engine exhaust manifold to the exhaust system. A rain cap will terminate the exhaust pipe after the silencer. All components must be properly sized to assure operation without excessive back pressure when installed.

2.7.3. The manufacturer shall supply a critical grade exhaust silencer as standard. For applications with site specific sound requirements (reference section 1.1), the silencer shall be selected to achieve site sound levels.

2.7.4. For gensets in a weather or sound attenuated enclosure, all exhaust piping from the turbo-charger discharge to the silencer shall be thermally wrapped to minimize heat dissipation inside the enclosure.

2.7.5. The engine intake air is to be filtered with engine mounted, replaceable, dry element filters.

3. Alternator

3.1. The alternator shall be a J0100124Y21 alternator with the voltage and phase configuration as specified in section 1.1.1.

3.2. The alternator shall be a 4-pole, revolving field, stationary armature, synchronous machine. The excitation system shall utilize a brushless exciter with a three phase full wave rectifier assembly protected against abnormal transient conditions by a surge protector. Photo-sensitive components will not be permitted in the rotating exciter.

The alternator shall include a permanent magnet generator (PMG) for excitation support. The system shall supply a minimum short circuit support current of 300% of the rating (250% for 50Hz operation) for 10 seconds.

The alternator shall have a maximum voltage dip of 35 %.

3.5. Three phase alternators shall be 12 lead, broad range capable of supporting voltage reconnection. Single phase alternators shall be four lead and dedicated voltage designs (600v) shall be six lead. All leads must be extended into a NEMA 1 connection box for easy termination. A fully rated, isolated neutral connection must be included by the generator set manufacturer.

The alternator shall use a single, sealed bearing design. The rotor shall be connected to the engine flywheel using flexible drive disks. The stator shall be direct connected to the engine to ensure permanent alignment. The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H" capable of withstanding 150 degrees C temperature rise.

The alternator shall be protected against overloads and short circuit conditions by advanced control panel protective functions. The control panel is to provide a time current algorithm that protects the alternator against short circuits. To ensure precision protection and repeatable trip characteristics, these functions must be implemented electronically in the generator control panel -- thermal magnetic breaker implementation are not acceptable.

An alternator strip heater shall be installed to prevent moisture condensation from forming on the alternator windings. A tropical coating shall also be applied to the alternator windings to provide additional protection against the entrance of moisture.

4. Controls

4.1. The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level 1.

The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: bi-fuel control, engine protection, alternator protection, speed governing, voltage regulation and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic engine control module (ECM) if so equipped. Generator controller's that utilize separate voltage regulators and speed governors or do not provide seamless integration with the engine management system are considered less desirable.

- 4.3. Communications shall be supported with building automation via the Modbus protocol without network cards. Optional internet and intranet connectivity shall be available.
The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and pc ribbon cable connections are considered unacceptable.
- 4.5. Circuit boards shall utilize surface mount technology to provide vibration durability. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components. A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out to the local servicing dealer when maintenance is required.
Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and .2 msec data logging capabilities.
In addition to standard NFPA 110 alarms, the application loads should also be protected through instantaneous and steady state protective settings on system voltage, frequency, and power levels.
- 4.9. The control system shall provide pre-wired customer use I/O, 4 relay outputs (user definable functions), communications support via RS232 and RS485. Additional I/O must be an available option.
- 4.10. Customer I/O shall be software configurable providing full access to all alarm, event, data logging, and shutdown functionality. In addition, custom ladder logic functionality inside the generator controller shall be supported to provide application support flexibility. The ladder logic function shall have access to all the controller inputs and customer assignable outputs.
- 4.11. The control panel will display all user pertinent unit parameters including: engine and alternator operating conditions; oil pressure and optional oil temperature, coolant temperature and level alarm; fuel level (where applicable); engine speed; DC battery voltage; run time hours; generator voltages, amps, frequency, kilowatts, and power factor; alarm status and current alarm(s) condition per NFPA 110 level 1.

5. Engine / Alternator Packaging

- 5.1. The engine/alternator shall be isolated from the generator frame with rubber isolators. The packaging shall not require the addition of external spring isolators.
A mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The breaker shall be rated at 150A/3P. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections. A second mainline, thermal magnetic circuit breaker carrying the UL mark shall be factory installed. The breaker shall be rated at 150A/2P. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections.
- 5.4. The generator shall include a unit mounted auxiliary power load center. All ancillary AC devices (block heater, battery charger, alternator strip heater, etc) shall have a dedicated breaker within the load center.
- 5.5. **Enclosure**
 - 5.5.1. The genset shall be packaged with a WEATHER PROTECTIVE enclosure.
 - 5.5.2. The enclosure shall be completely lined with sound deadening material. This material must be of a self extinguishing design with a reflective surface for enhanced serviceability.
 - 5.5.3. The enclosure shall be made of steel with a minimum thickness of 16 gauge. The enclosure is to have hinged, removable doors to allow access to the engine, alternator and control panel. The hinges shall allow for door fit adjustment. Hinges and all exposed fasteners will be stainless steel or Sermagard coated. The use of pop-rivets weakens the paint system and not allowed on external painted surfaces.

Each door will have lockable hardware with identical keys.

5.5.4. The enclosure shall be coated with electrostatic applied powder paint, baked and finished to manufacturer's specifications. The color will be manufacturer's standard. The enclosure shall utilize an upward discharging radiator hood. Due to concerns relative to radiator damage, circulating exhaust, and prevailing winds, equipment without a radiator discharge hood will not be acceptable.

5.5.6. The genset silencer shall be mounted on the discharge hood of the enclosure. Due to architectural concerns, silencers mounted on the top of the generator enclosure are not acceptable. Gensets with silencers mounted inside the main generator compartment are acceptable only if the silencer is thermally wrapped to minimize heat stress on the surrounding components.

Sub-base fuel tank

5.6.1. The packaging shall include a double wall, sub-base mounted, UL142 listed fuel tank. The tank shall be sized to provide 24 hours of run time.

5.6.2. The tank shall include fuel suction and return connections, normal and emergency vents, secondary containment emergency vent and rupture basin sensor, mechanical fuel level indication and a stub-up area convenient for electrical conduit entry.

5.6.3. The fuel tank shall use an electric fuel sensor to provide an analog indication of fuel level. The controller shall have a warning indication on low fuel level and provide optional shutdown functionality for low, low fuel level.

5.6.4. The fuel tank must be supplied by the engine-generator set manufacturer and be installed before shipment.

6. Loose Items

Supplier to itemize loose parts that require site mounting and installation. Preference will be shown for gensets that factory mount items like mufflers, battery chargers, etc.

6.2. Spare Parts:

6.2.1. Fuses: One spare set

6.2.2. Filters One spare set (air, fuel, oil)

7. Additional project requirements

7.1. Factory testing

7.1.1. Before shipment of the equipment, the engine-generator set shall be tested under rated load for performance and proper functioning of control and interfacing circuits. Tests shall include:

7.1.1.1. Verify voltage & frequency stability.

7.1.1.2. Verify transient voltage & frequency dip response.

7.1.1.3. Load test the generator for 2 hours.

7.2. Manuals

7.2.1. Three (3) sets of owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instruction, preventive maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

7.3. Installation

7.3.1. Contractor shall install the complete electrical generating system including all external fuel connections in accordance with requirements of NEC, NFPA, and the manufacturer's recommendations as reviewed by the Engineer.

7.4. Service

7.4.1. Supplier of the genset and associated items shall have permanent service facilities in this trade area.

These facilities shall comprise a permanent force of factory trained service personnel on 24 hour call, experienced in servicing this type of equipment, providing warranty and routine maintenance service to afford the owner maximum protection. Delegation of this service responsibility for any of the equipment listed herein will not be considered fulfillment of these specifications. Service contracts shall also be available.

7.5. Warranty

7.5.1. The standby electric generating system components, complete genset and instrumentation panel shall be warranted by the manufacturer against defective materials and factory workmanship for a period of ten (10) years. Such defective parts shall be repaired or replaced at the manufacturer's option, free of charge for parts, labor and travel.

7.5.2. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. Also, in the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have the necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

7.6. Startup and Commissioning

7.6.1. The supplier of the electric generating plant and associated items covered herein shall provide factory trained technicians to validate the completed installation and to perform an initial startup inspection to include:

7.6.1.1. Ensuring the engine starts (both hot and cold) within the specified time.

7.6.1.2. Verification of engine parameters within specification.

7.6.1.3. Verify no load frequency and voltage, adjusting if required.

7.6.1.4. Test all automatic shutdowns of the engine generator.

7.6.1.5. Perform a load test of the electric plant, ensuring full load frequency and voltage are within specification by using building load.

7.7. Training

7.7.1. Training is to be supplied by the start-up technician for the end-user during commissioning. The training should cover basic generator operation and common generator issues that can be managed by the end-user.

7.7.2. Training is to include manual operation of system.