CITY OF ADA Purchasing
512 North Stockton Street
Ada, Oklahoma 74820
580/436-8042

BID NOTICE
September 27th, 2025

Bid Proposal: 26-72-07
Item: GENERATOR 1,000KW WITH CONTROLS AND AUTOMATIC TRANSFER SWITCH
Bid Due: October 22nd, 2025 @ 1:30 pm cst at City of Ada Purchasing Dept., 512 N. Stockton St, Ada, OK 74820
Bid Opening: October 22nd, 2025 @ 2:00 pm cst at City Hall Council Chambers, 231 S. Townsend St, Ada, OK
Mailing Address: City of Ada - Purchasing 512 N. Stockton Ada, OK 74820
Published: Ada Evening News, September 27th & October 4th, 2025

NOTICE IS HEREBY GIVEN THAT:
The City of Ada, Oklahoma and its agencies/authorities herein called (BUYER) will receive **SEALED BIDS** as listed above at which time said bids will be opened and read aloud.

Complete specifications and conditions, etc. and bidding information may be obtained from the City of Ada Purchasing Office, 512 N. Stockton, Ada, OK or at www.adaok.com.

GENERAL CONDITIONS

01. Bidders must complete and submit bid on the provided bid documents. Duplication of bid documents is authorized.
02. Bids must be submitted in a sealed envelope clearly marked "**SEALED BID**" and bear the bid number, item, and bidder's name. Bids improperly marked, submitted, and/or received after the bid opening may be rejected unless lateness is due to other than the bidder's fault -- such as mail or delivery errors. **FAX bids are not acceptable**.
03. The BUYER is an Equal Opportunity Employer and purchases only from those that comply with applicable Equal Opportunity Provisions. Non-compliance will result in rejection of bids and/or breach of contract.
04. **The bid amount must be FOB -- Ada, OK and exclude all taxes**.
05. Unless so stated, bids will be evaluated by Life Cycle Cost and will be awarded on a "Best Buy" basis as determined by the BUYER.
06. Offer Period – 30 days after the bid opening unless so stated. Formal acceptance will be by receipt of a valid purchase order issued by the BUYER within the offer period.
07. **PAYMENT** -- Full payment will be made approximately 3 weeks AFTER receipt and acceptance of the goods/services and required documents.
08. The BUYER reserves the right to negotiate changes/alterations/quantities to the base bid with the low bidder.
09. The BUYER reserves the right to waive any informalities in the bidding process and/or reject all bids.
10. Mistakes, Errors, Bid Withdrawal, or Adjustments.
    A. Prior to bid opening, bidders may withdraw or alter their bids or submit adjustments or attachments provided the total bid amount is not revealed and it does not provide an unfair advantage to the bidder.
    B. After bid opening, only corrections of obvious errors will be accepted.
11. Bond Requirements: None
12. Insurance Requirements: None
13. Bid Documents: Bid Notice, Bid Proposal Form, and Detailed Specifications.

Pamela McKinzie, Purchasing Director

CITY OF ADA
BID# 26-72-07
GENERATOR 1,000KW WITH CONTROLS AND ATS

Submitted by: _____

Submitted to: **CITY OF ADA, OKLAHOMA** 512 North Stockton Ada, OK 74820
Bid Due: **September 22nd, 2025 @ 1:30 PM CST at City of Ada Purchasing Dept., 512 N. Stockton St, Ada, OK** 74820
Bid Opening: **September 22nd, 2025 @ 2:00 PM CST at City Hall Council Chambers, 231 S. Townsend St, Ada, OK**

This is a formal bid proposal submitted by the bidder to the City of Ada, Oklahoma and its Agencies/authorities herein called (BUYER), as a legal offer. When properly accepted by an authorized agent of the BUYER, it shall constitute a firm and binding contract between these two parties in accordance to the conditions and specifications stated and/or implied within the bid documents.

PURPOSE:
This bid is intended to provide one (1)each New 1,000 KW reciprocating engine-driven generator with controls and Automatic Transfer Switch (ATS). The generator will be new and must meet or exceed the specifications as written in the bid. The generator, controls and automatic transfer switch will be delivered to the **CITY OF ADA** Wastewater Treatment Plant, 1800 N. Mississippi, Ada, OK. *Offloading shall be performed by an Electrical Contractor under separate bid/contract with the **CITY OF ADA** for installation of the generator and ATS. Bidder shall coordinate with the Electrical Contractor for delivery and offloading date and time*. The evaluation of this bid will be determined by the specification qualification, the price and the delivery time of the generator.

Bid Price Period: _____

Generator Year-Make-Model:_____

Automatic Transfer Switch
Year-Make-Model:_____

Delivery Time: _____

Price: $_____

GENERAL SPECIFICATIONS:
Section 26 32 13.13 : Engine-Driven Generator - Onboard Parallel
Section 26 36 00 : Automatic Transfer Switches
(***Any reference to one manufacturer's equipment is meant as being descriptive only as to level of quality and type of equipment desired, but not restrictive as to manufacturer.)***

NON-COLLUSION AFFIDAVIT

The undersigned, of lawful age, being first duly sworn, on oath, says that (s)he is the bidder or bidder's authorized agent, and is authorized to submit this bid (offer). Affidavit further states that the bidder, or bidder's agent, has not been a party to any collusion among bidders in the restraint of freedom of competition by agreement to bid at a fixed price or to refrain from bidding; or price in the prospective contract; or in any discussion between bidder and/or any BUYER officials concerning exchange of money or other things of value for special consideration on the letting of this bid.

BUSINESS RELATIONSHIP AFFIDAVIT

If none of the business relationships mentioned exist, affidavit should so state "NONE".

The undersigned, of lawful age, being first duly sworn, on oath says that (s) he is the bidder or bidders authorized agent to submit this bid. Affidavit further states that the nature if any partnership, joint venture, or other business relationship presently in effect or which existed within one (1) year prior to the date of this bid with any BUYER officials or employee is as follows:

_____

Affidavit further states that any such business relationship presently in effect or which existed one (1) year prior to this bid between the bidder or officers or employees of the BUYER or other party to this bid is as follows.

_____

Affidavit further states that the names of all persons having any such business relationship and the positions they hold with their respective companies or firms are as follows:

Firm: _____ Name: _____

Address: _____ Signature: _____

City/St/Zip: _____ Title: _____

Phone: _____ Date: _____

NOTARY

Subscribed and sworn before me this _____ day of _____, 202__

My notary expires _____. Notary: _____.

CONTRACTOR/BIDDER INFORMATION SHEET

To be completed by all Bidders
For Contracts with the City of Ada
(Please print or type)

Project No. or Description _____

_____

Full Name of Bidder _____

Legal Identity _____
(Corporation, Partnership,
Individual, etc.)

Address _____

City, State, Zip _____

Telephone No. _____

Fax No. _____

Taxpayer Identification Number _____

Contact Person _____

Phone No. _____

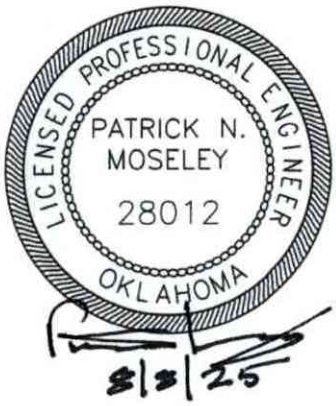
Fax No. _____

E-mail address _____

Web page Address _____

City of Ada, WWTP Backup Generator and Transfer Switches Specifications

Prepared For	City of Ada, Oklahoma
Prepared By	Marco A. Barrera, PE. Alexander Pierce
Reviewed by:	Patrick Mosley, PE
Project Manager:	Ana Pena-Tijerina, PE
DATE	08/07/2025.
VERSION	Version 2.0
PROJECT NO.	Plummer Project No. 0870-005-01



PLUMMER

Plummer Associates, Inc.
531 Couch Dr., Suite 200
Oklahoma City, Oklahoma 73102
405-440-2725
Oklahoma Firm Number - 1097

SECTION 26 32 13.13
RECIPROCATING ENGINE-DRIVEN GENERATOR - ONBOARD PARALLEL

PART 1 - GENERAL

1.1 SUMMARY

A. Section provides requirements for third party furnished, contractor coordination, contractor installation, and services reciprocating engine-driven generator set work as shown, scheduled, indicated, and as specified.

B. Related Sections include but are not necessarily limited to:

1. OWNER Procurement requirement

1.2 REFERENCES

A. Where reference is made to one of the standards, the revision in effect at the time of bid opening shall apply.

B. All material and equipment, for which a UL standard exists, shall bear a UL label. No such material or equipment shall be brought onsite without the UL label affixed.

C. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents shall take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the CONTRACTOR unless otherwise directed by the OWNER/ENGINEER.

D. Equipment shall comply with applicable sections of the latest edition of the following standards:

1. NFPA 70 (NEC).
2. NFPA 37 and NFPA 110.
3. IEEE Standards for Paralleling Synchronizing.
4. NEMA.
5. ANSI.
6. Oklahoma Department of Environmental Quality (DEQ)
7. Federal Requirements (EPA Tier Levels for Non-Road Engines) Latest effective requirements.

1.3 ADMINISTRATIVE REQUIREMENTS.

A. Third party herein this document refers to Generator Manufacturer Supplier, representative vendor.

B. Contractor herein this document refers to Installer, integration, start-up, testing, commissioning, and warranty provider of generator and ancillary equipment to make system complete and functional.

C. Owner herein this document refers to The City of Ada Oklahoma.

D. Engineer herein this document refers to Engineer designer.

1.4 SUBMITTALS

A. General Requirements: Generator supplier to Comply with the submittal requirements of City of ADA "Submittal Procedures" or as requested by engineer, and as described below.
   1. Purchase order must not be executed without the authorization of the Engineer and the Engineer representative for the City of Ada.
   2. All submittals must be done electronically in PDF format.
   3. A cover letter with all the manufacturer deviations/exceptions of this specification must be provided in a table at the beginning (first pages) of the submittal.

B. Shop Drawing submittals shall include, but not be limited to, the following:
   1. A written description of the system operation (written in this specification format) with all exceptions and/or deviations clearly highlighted or identified.
      a. System minimum operation description:
         1) Automatic stand-by star-up upon utility outage.
         2) Interlock (no grid close transition)
         3) Manual start-up
         4) Automatic parallel to common bus or dead bus.
         5) Testing/exercise mode.
   2. Completely identified and marked catalog cuts of all associated equipment and devices, with all non-applicable items crossed out, and applicable equipment or devices clearly highlighted or identified.
   3. A written description of the maximum "starting" and "running" kVAs and kWs of the system equipment (charts and graphs will not be acceptable without a description or tables).
   4. A floor plan sketch complete with a dimensional description of the standby electric power system and associated equipment, locating the system equipment and accessories within the allotted space.
   5. Interconnection wiring diagrams to indicate terminal connections between the remote alarm annunciator panel and the electric set.
   6. Complete bill of material for all equipment.
   7. Complete warranty information as specified.
   8. A notarized letter from the system supplier certifying compliance with all requirements of this Specification.
   9. Performance test as specified in Paragraph 1.5/D of this Section.

C. Manufacturer’s Instructions for the shipping, handling, storage, installation, start-up, operation, and maintenance, with schedule, of the equipment (in both hardcopy and digital formats).

D. Manufacturer’s certification of satisfactory installation, calibration, and testing.

E. Proof of Warranty.

1.5 QUALITY ASSURANCE:

A. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems and with NFPA 37, "Installation and Use of Stationary Combustion Engines and Gas Turbines", and NFPA 110, "Emergency and Standby Power Systems".

1. Generator system herein to comply with Legally required system per NEC 701.
2. Generator disconnecting means and remote emergency shutdown NEC 445.18
3. Other provision required per NFPA 37, 110, and 70.

B. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to generator construction.

C. Emissions Compliance: The generator set engine shall comply with all applicable Oklahoma Department of Enviromental Quality Regulations and Requirements for City of Oklahoma area and shall comply with all applicable EPA Tier Levels for Non-Road Engines that is currently in effect for the City of Ada Oklahoma area.

D. Performance Tests: The performance tests of the generating set series shall be in accordance with procedures certified by an independent testing laboratory. The manufacturer shall have successfully tested a prototype of the generating set series offered which shall include:

1. Maximum power level.
2. Maximum motor starting capacity.
3. Structural soundness.
4. Torsi graph analysis per MIL-STD-705B, Method 504.2.
5. Fuel consumption.
6. Engine-alternator cooling airflow.
7. Transient response and steady state governing.
8. Alternator temperature rise per NEMA MG1-22.40.
    a. 105C Temp Rise over 40 C
9. Single step load pickup per NFPA 76A-822.
10. Harmonic analysis and voltage waveform deviation per MIL-STD-705B, Method 601.4.
11. Three-phase short circuit test for mechanical and electrical strength.

E. Manufacturer: The system shall be built, tested, and shipped by the manufacturer of the Standby Electric Power System, who has been engaged in the production of engine-alternator sets and associated controls for a minimum of 10 years, so there is one source of supply and responsibility.

1.6 DELIVERY, STORAGE, AND HANDLING

A. The generator set(s) shall be stored at the factory until they must be shipped to the job site to prevent building construction delay or by instructions of Installer in coordination with Owner.

B. The generator set(s) shall be created and covered to protect it from damage during shipment and subsequent storage at the job site or by instructions of installer in coordination with owner.

1.7 SITE CONDITIONS

A. The equipment, sizes, materials, and arrangements described in this section are based on recommendations by equipment suppliers and shall be considered minimum limits of acceptability. The manufacturer shall be responsible for design, arrangement, and performance of all equipment supplied under this section.

B. Environmental Conditions:

1. All equipment including controls specified herein shall be specifically designed to be installed for this service and the environment encountered in this installation, unless noted otherwise.

2. The environment will be moist, and corrosive, exhibiting hydrogen sulfide and other corrosive gases encountered in municipal wastewater treatment plants.

3. All equipment shall be designed and capable of operation outdoors at ambient temperatures of 0°F to 120°F, with indoor operating temperature of 140°F.

a. For alternator and cooling system adjusted to supply 100% of power at the temperature listed on this part.

1.8 WARRANTY

A. Extended Equipment Warranty: As required by Owner or 5 year comprehensive warranty (Standard warranty + extended = 5 Year).

1. Owner as the only discretion on reducing the warranty purchase to standard warranty. Supplier/installer can request this exception prior acceptance of purchase order.

B. All equipment furnished under this section, by manufacturer supplier or by contractor shall have a special equipment warranty, in accordance with the Contract Documents, for a period of two (2) years after the date of Substantial Completion. The cost for the removal, shipment, repair or replacement, and installation of components by Installer shall be included in the warranty and correction of defective work.

1.9 MAINTENANCE

A. Extra material:

1. Special tools: as recommended by manufacturer,.

a. Supplied by manufacturer.

b. 3 set of keys for generator door enclosures.

2. Generator manufacturer and equipment supplier to provide matching finish paint for touching up damaged surfaces after installation.

B. Maintenance Service:

1. Maintenance by Owner. Owner will designate on separate contract maintenance for equipment. A written report of each maintenance visit shall be available to the Owner within 10 days if requested.

2. The contract shall include, but not be limited to, the following:

a. First manufacturer service per manufacturer O&M.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, are listed below:

1. Caterpillar Tractor Company.

a. Model Family C32 PGDG or equivalent per manufacturer.

2. Or equal.

2.2 ENGINE-GENERATOR SETS:

A. General: generator supplier to provide an outdoor rated engine-driven generator set[s], complete with safety devices, main output breaker, weatherproof enclosure and vibration isolators. Unit[s] shall be capable ostandby service, built-in paralleling capabilities with onboard contactor (transfer switch) able to synchronize with other future generator (same brand) or common bus (same brand as generator).

B. Design Basis: The generator set(s) specified is based on a existing project electrical design loads drawings and selected from data derived from manufacturer's engineering manuals. Generator size and selection are solely by owner and engineer.

C. Utility Interconnection: Generator and onboard controls design are NOT intended for close transition with power utility. This generator set design is not intended for Utility interconnection.

1. Electrical interlock must inhibit ATS or system from operation with main service entrance disconnect in the close position or with utility power.

D. System Capacity: The engine-generator set, as a unit or parallel system, shall be fully rated for a Stand-by power capacity. Generator must be rated min. 1,000 KW (1250 KVA) at 0.8 p.f. with an output of 1500 Amperes while generating 480Y/277 volt, 3-phase, 4-wire, 60 Hz power, and with performance as specified herein.

1. Stand-by Power use generation. EPA Stationary Emergency Generator.

E. Reciprocating engine shall be a min. 12 cylinder, turbocharged/aftercooled, fuel injected Diesel, water-cooled with belt driven water pump. Following items shall be included:

1. Valves: Intake and exhaust valves shall be heat-resisting alloy steel, free rotating. Exhaust valve seat inserts shall be replaceable.

2. Battery Charging: Belt-driven engine alternator; 24 volt negative ground 35 amp dc, with transistorized voltage regulator.

a. Dual 12 vdc battery systems will be accepted, charging mechanism to be 24 vdc, 35 amps minimum.

3. Governor: Electronic speed-sensing governor capable of isochronous frequency regulation from no load to full rated load. Speed droop shall be externally adjustable from isochronous to 5%.

a. Frequency drop max limit to 5% for step system loading.

4. Filters: Air cleaner, fuel and lube oil filters shall have replaceable elements + clear glass.

5. Starting System: Remote 24 volt, 2-wire, negative ground, starting system, positive shift, gear engaging electric starter, cranking limiter.
6. Lubrication System: Forced feed gear design lube oil pump; full pressure lubrication to all bearings; dual, full flow oil filters; oil level indicator; low oil pressure shutdown; lube oil cooler; and oil pressure gauge.
7. Diesel Fuel System: Ultra low sulfur diesel fuel. System shall be fuel injected and shall include a fuel pump, automatic fuel shutoff, fuel oil/water separator, and fuel filters.
8. Cooling System: The cooling system shall be unit mounted radiator cooled, self-sealing prelubricated coolant pump; belt driven pusher fan with wire guard; thermostat temperature control; high coolant temperature shutdown; low coolant level shutdown; intercooler. The cooling system shall be tested for leaks. As soon as the system has been tested, it shall be filled with ethylene glycol rust inhibiting and antifreeze solution sufficient to protect the system to 0°F. Engine-driven pusher type cooling fan shall be sized to maintain safe operation at 140°F indoor and 120°F outdoor maximum ambient temperature while providing full power rating. Airflow restriction from static pressure at the radiator discharge shall not be more than 0.5" of water.
    a. Cooling louvers must be design to have a free air intake and exhaust free space of 10 feet.
9. Emissions Compliance: The generator set engine shall comply with all applicable Current State and Federal Regulations and Requirements for Oklahoma area and shall comply with all applicable EPA Tier Levels for Non-Road Engines that is currently in effect for the City of Ada area at the time of installation.

F. Set Characteristics: Set manufacturer shall certify that reserve horsepower is available from the engine with all accessories operating in the ambient conditions hereinbelow. The reciprocating engine-generator set shall be capable of picking up 100% of nameplate kW and power factor, less applicable derating factors, in one step with the engine-generator set at operating temperature, in accordance with NFPA 110, Paragraph 5.13.2.6, and including the following constraints:
    1. Ambient conditions of 1050' altitude and an ambient temperature of 0 to 120°F Outdoors.
    2. The rpm of the engine shall not exceed 1800 rpm and the engine piston speed shall not exceed 2000 per minute.

G. Engine Protective Devices:
    1. The engine protective devices shall provide automatic shutdown for overcrank, overspeed, high coolant temperature and low oil pressure. A low coolant level protective device shall be provided but shall alarm only and not initiate engine shutdown
    2. The high coolant temperature and low oil pressure shall have pre-shutdown signals.
    3. The overcrank alarm shall be the output of a solid-state cranking device preset at a 10 second cranking cycle and a 15 second rest cycle. If the engine fails to start on the third cranking cycle (60 seconds), the overcrank & Generator failure alarm shall sound and cranking shall stop. Unit shall be capable of repeating the above cranking cycle after the trouble has been cleared with manual override or by SCADA if available on site.

4. Generator engine Must comply with Oklahoma Department of Environmental Quality (DEQ) section 252:656-7-4:

   A) Engine protection. The engine must be protected from operating conditions that would result in damage to equipment. Unless continuous manual supervision is planned, protective equipment shall be capable of shutting down the engine and activating an alarm.

   (B) Size. The engine shall have adequate rated power to start and continuously operate all connected loads. The engines shall be capable of handling the peak capacity of the station.

   (C) Routine start-up. All emergency equipment shall be provided with instructions indicating the need for regular starting and running of such units at full loads.

   (D) Equipment protection. Emergency equipment shall be protected from damage due to restoration of regular electrical power.

   (E) Instructions, tools and parts. Post a complete set of operational instructions, emergency procedures and maintenance schedules at the station. Provide any special tools and spare parts.

H. Generator: Generator shall be 4-pole, revolving field type, brushless, dynamically balanced, skewed laminated, two thirds pitch wound, rotating rectifier exciter, temperature compensated solid-state voltage regulator, open dripproof, single bearing, permanently aligned generator connected to engine with flexible disc coupling, including the following:

   1. NEMA Class F or better insulation as defined by NEMA MG1.65.
   2. Temperature rise at rated load within NEMA MG1-22.40 definition.
      a. Temp rise 105C over 40C Ambient. (155 C)
   3. Double-sealed ball bearings, lubricated for life.
   4. Direct-drive centrifugal blower cooling.
   5. A 120-volt, single phase space heater shall be provided to prevent condensation in the generator.
   6. AC output leads shall be brought out to field connection busbars accessible through removable plates in the generator output junction box.
   7. The automatic voltage regulator shall be a solid-state design and include overvoltage and undervoltage protection functions. The voltage regulator shall be equipped with 3-phase RMS sensing. The regulator shall control buildup of ac generator voltage to provide a linear rise and limit overshoot. Overvoltage protection shall sense the ac generator output voltage and in the event of regulator failure or loss of reference, shutdown regulator output on a sustained overvoltage of one second duration. Over excitation protection shall sense regulator output and shutdown regulator output if overloads exceed 10 seconds Duration. Both overvoltage and over excitation protection shutdowns shall be latched, requiring generator set shutdown to reset.

I. Generator Output Circuit Breaker(s): Generator set shall have 3 pole output circuit breaker(s) with solid state trip units as shown on the drawings. Breaker frame and trip ratings shall be as shown on the drawings. Breakers serving emergency and standby loads shall have breaker position indicating contacts. Breaker position indicating contacts shall be wired to initiate a generator control panel alarm when the breaker is open or tripped.

Circuit breaker manufacturer and type for all breakers serving emergency and standby loads shall match the project electrical gear package to provide compatibility for selective coordination required by the NEC. Generator breakers shall have ground fault protection and shunt trip capabilities.

J. Paralleling:

1. Generator Onboard transfer mechanism must be able to perform the power transfer within the generator enclosure or generator frame.
2. Generator Onboard Controller must be able to synchronize to:
    a. A dead bus.
    b. Common bus.
    c. Featured Synch Check relay ANSI (25) relay.
3. Generator Onboarding Synchronization. Generator(s) must be able to have an IEEE 1547 maximum 5-cycle power transfer within generator enclosure.
    a. Generator must be capable to intercommunicate with a-like generators from same manufacturer, in a series manner or through a master controller.

K. Engine/Generator Set Performance:

1. Frequency Regulation: Isochronous from no load to full rated load.
2. Voltage Regulation: Plus 2% no load to rated load; rheostat for 5% voltage adjustment.
3. Voltage Dip (max. 15%): Instantaneous voltage dip shall be less than 15% of rated voltage when full, 3-phase load and rated power factor is applied to the generator. Recovery to stable operation shall occur within 5 seconds. Stable or steady state operation is defined as operation with terminal voltage remaining constant with _1% of rated voltage. All unit performance characteristics shall be verified using an oscilloscope.
4. Total Harmonic Distortion (THD): The sum of ac voltage waveform harmonies, from no load to full linear load shall not exceed 5% of the rated voltage (L-N, LL, L-L-L) and no single harmonic shall exceed 3% of rated voltage. Telephone Influence Factor (TIF) shall be less than 50 per NEMA MG1-22.43. Temperature rise at rated load and power factor shall be within NEMA MG1-22.40 definition.

L. Engine-Generator Instrument Panel: The instrument panel shall be mounted on vibration isolators and shall have dc controls, ac controls, and panel lighting. The top of the instrument panel shall not be more than 6'-6" above finished floor.

1. DC engine controls (2-wire, 24 volt system) including but are not limited to run-stop-automatic test-manual switch, remote start-stop terminals, oil pressure gauge, coolant temperature gauge, charge rate ammeter and running time hour meter.
2. Solid state engine monitoring system with monitors in accordance with NEC Section 700, NFPA 110 and local code requirements with lamps, audible alarm, lamp test switch, individual alarm contacts and a common alarm contact for:
    a. Overcrank shutdown
    b. Low coolant temperature warning
    c. Pre-warning for high engine temperature
    d. High engine temperature shutdown

e. Pre-warning for low lube oil pressure
f. Low lube oil pressure shutdown
g. Overspeed shutdown
h. Low fuel
i. Low coolant level warning
j. Generator (EPS) supplying load.
k. Generator control switch not in auto position warning
l. High battery voltage warning
m. Low cranking voltage warning
n. Low battery voltage warning
o. Battery charger failure
p. Generator output breaker(s) open warning

3. Provide two dry auxiliary contacts, one for common alarm and one for engine running to be monitored by the Plant Control System/SCADA/Other provided by Owner. Provide other Alarm contacts as required by drawings (if applicable).
4. AC output controls include, but are not limited to, an ac voltmeter; ac ammeter; voltmeter-ammeter phase selector with an "off" position; voltage adjusting rheostat; frequency meter; manual reset exciter circuit breaker and fine speed control potentiometer.
5. AC Ancillary required power: Generator enclosure must be able to receive a single power feeder for all ancillary equipment supporting the generator. Power requirements shall be 100 amp, 208/120 VAC, 3-phase feeder, continuous demanded current of 60 amps.
    a. Alternatively a 480 VAC, 3 phase system with integral step down transformer 35 KVA and internal 3 phase 100 amp power distribution panel is acceptable if the available power for ancillary equipment is 480 VAC, 3-phase. Coordinate with existing site conditions.
6. Jacket-Water Heater: The engine shall have an 208 volt, 3-phase 2000W jacket-water heater supplied from a "normal" branch circuit. The jacket-water heater shall be complete with a thermostat capable of maintaining a water temperature of 70°F, with an ambient temperature of 32°F. A water temperature alarm, consisting of a contact closed when the jacket water temperature is below 50°F, shall be supplied.
7. Exhaust System: Exhaust silencer(s) of the "critical" type, with side or end inlet as required. The exhaust silencer(s) shall be of chambered construction and shall provide maximum degree silencing and shall be sized to assure proper operation without excessive back pressure when installed in the exhaust system. The exhaust silencer(s) shall be supplied with condensation drains, flexible exhaust tubing, wall thimbles and rain caps, as required.
8. Starting Batteries: Furnish and install fully charged 24-volt lead acid, impact resistant, storage batteries system mounted on the unit or on a separate rack. Batteries shall have sufficient capacity for 60 seconds of continuous cranking per NFPA 99. Provide all required battery cables, connections, electrolyte and a battery hydrometer.
9. Solid-State Battery Float Charger: A suitable 120 volt automatic SCR voltage regulated battery charger with a maximum charge rate, as recommended by the manufacturer,

but not less than 10 amperes shall be provided to maintain each set of batteries at full capacity during standby conditions The maximum charging time to bring the batteries up to full charge shall not exceed 12 hours. The charger shall be provided with a remote alarm contact to indicate a charger failure condition. An ammeter shall indicate the charge rate and the circuit shall be protected by either fuses or circuit breakers. The charger shall be so designed that it will not be damaged during the engine cranking and shall be interlocked such that it is not damaged during generator set operation. The charger may be furnished as a separate item with necessary cables and leads.

10. In Skid Diesel Fuel Tank: Each generator set shall be provided with the manufacturer's standard in skid fuel mounted tank. The tank shall be 24 hours at full load with a 15% maximum voltage drop. The tank shall not extend outside the dimensions of the standard generator set skid base. The fuel tank shall be new and unused and shall not be galvanized. The fuel system piping to the generator shall be no smaller than the minimum recommended by the engine manufacturer to avoid fuel flow restriction. Flexible connections shall be provided in the generator full supply and return piping. Each fuel oil tank shall have a SPDT low fuel level sensing device set to change state when a 2-hour usable fuel level remains in the tank. Each tank shall be provided with a fill connection, tank normal and emergency vent connection with UL listed caps and a tank fuel level gauge calibrated in gallons. Tanks shall be provided with EPA approved secondary containment and shall include leak detection in the containment section and a leak detection alarm output to be wired to the remote annunciator. The second set of fuel level switch contacts shall be wired to a terminal block for field wiring to the fuel oil control panel.
11. Vibration Isolation: Suitable aluminum housed, spring type vibration isolators be provided. Isolators shall be sized to properly support the generator set and to isolate 99% of the generator's vibration from the supporting structure.
12. Skid Base: The entire packaged unit shall be mounted on a skid base of welded structural steel, of box type construction suitable for mounting on spring vibration isolators. A sloped drip pan shall be provided for containing engine fluid spills. Provisions for stub up of electrical and fuel connections shall be within the footprint of the generator set base rails.
13. Generator Access Platform: Generator must provide Access platform OSHA compliant.
    a. Material: Aluminum or Hot dip galvanized steel.
14. Painting: The entire engine generator set shall have all exposed metal surfaces primed with a rust inhibiting primer and multiple finish coats of the manufacturer's standard machinery enamel finish.
    a. Enclosure/fuel tank grounding must be done to bare metal per NEC and manufacturer instructions. After solid ground installation contractor must prime and finish coat to inhibit corrosion.

2.3 ENCLOSURE:

A. The complete reciprocating engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, sound attenuated, rodent-proof enclosure mounted on the fuel tank base.
    1. UL 2200 Compliant.

2. A Level 2, weather resistant, sound attenuated enclosure of steel with electrostatically applied powder coated baked polyester paint. The enclosure shall have a resulting sound level of not more than 78 dba @ 23 ft with the genset running under full load. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel.
3. Level 2 Enclosure Sound Attenuation: Acoustical foam shall be provided between all supports and inside doors and sound baffles on air intake and air discharge.
4. Generator enclosure exhaust/intake radiator louvers must be fixed.
    a. Design must not allow ingress of snow, sleet, ice, birds, and other animals.
    b. Louvers must operate in an event of ice, snow, sleet, and hail storms.

PART 3 - EXECUTION

3.1 INSTALLATION OF ENGINE-DRIVEN GENERATOR SETS:

A. Installation by contractor. Installation instructions under this document are recommended. Final installation must be under manufacturer's instructions.

B. General: Install engine-driven generator sets where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices, to ensure that the sets comply with the specified requirements and serve the intended purposes.

C. Standards: Comply with NEMA standards, requirements of the NEC and applicable portions of NECA's "Standard of Installation" pertaining to installation of legally required engine-driven generator sets and accessories.

D. Vibration Mounts: Install units on properly sized [inertia base with] spring type vibration mounts and ribbed neoprene vibration isolators; comply with manufacturer's indicated installation method as applicable.

E. Connections and materials: Contractor to furnish all conductors, connectors, and materials that are not part of the generator, but are necessary to make the system complete and functional.

3.2 GROUNDING:

A. General: Install the generator(s) as a non-separately derived system per NEC. Do not ground the generator neutral to the generator frame. Ground the generator frame through the feeder grounding conductor. Refer to NEC Article 250.
    1. Frame grounding and exterior frame grounding must be manufacturer approved to avoid paint finish chipping or corrosion of the tank/frame.
    2. Approve dissimilar metal bonding hardware must be provided to avoid galvanized corrosion.

3.3 CONTROL WIRING:

A. General: Provide generator start-up control wiring from controllers, switchboard, alarms, switches, PLC, any other external control cabinet device, instruments, and control relays.

B. Annunciators: Provide control wiring to remote generator annunciators in locations specified and as shown on the Drawings.

3.4 INITIAL START-UP AND SYSTEM CHECKOUT:

A. Commissioning as required by NEC 701.3 by engineer, installer and City of Ada Operators (AHJ)

B. A complete installation shall be initially inspected by Engineer, adjusted and started and checked out for operational compliance by representatives of the manufacturer. All start-up documentation shall be turned over to the Engineer and operator.

C. The engine lubrication oil and antifreeze shall be provided by the supplier of the electric set for operation under environmental conditions as recommended by the manufacturer.

3.5 TESTING:

A. General: Testing musty be completed under Engineer direction and as recommended by manufacturer. The following testing description are recommended:

1. Upon completion of installation of engine-driven generator set(s), transfer switches and after building circuitry has been energized with normal power source, test power system to demonstrate standby capability and compliance with specified requirements, including automatic start-up, controls, and full load acceptance. Tests shall include operation of standby power system (legally required) with voltage check while the system is loaded to ensure proper operation of the emergency generator, transfer switches, and other system components. Operation of the system shall simulate standby power conditions, that is, loss of main electrical power to the building. Test period shall be a minimum of 2-hours continuous trouble- free operation with at least four automatic transfer switch operations for each switch within the period of operation. All diesel fuel for testing and filling tank at completion of successful testing shall be provided under the project scope.

2. Test Load: Testing shall be performed at 0.8 PF with loads as specified hereinbelow. Where the specific set has been factory tested at 0.8 PF as specified hereinbelow, field-testing may be performed at 1.0 PF. The supplier of the engine-generator set shall provide a load bank of sufficient capacity to complement the available building load for testing. The field test shall include running the emergency power system under loads as specified below:

   a. 30 minutes at 25% of rated load (field load bank).

   b. 1 hour at 50% of rated load (field load bank).

   c. 3 hours at 75% of rated load (field load bank).

   d. 3 hours at 100% of rated load (field load bank).

   e. Miscellaneous building loads may be used to supplement load bank.

   f. Miscellaneous facility loads may be used at direction of electrical engineer or plant operator to verify start up capabilities during testing.

3. Test Readings: The voltage current and frequency readings shall be recorded at 15-minute intervals throughout the test. Each automatic transfer switch shall automatically operate a minimum of four times during the test. There shall be a 15-minute unloaded run at the conclusion of the test to allow engine to cool before shutdown. The Contractor shall make all necessary hook-ups to facilitate field-test and shall furnish all fuel necessary for field-testing.

4. Submittals: Contractor shall furnish all instruments and personnel required for tests.

Submit four copies of certified test results to Engineer for review. Test reports shall include date and time of test, relative humidity, temperature, and weather conditions.

3.6 OPERATOR TRAINING:

A. The manufacturer's start-up representative shall provide a minimum of 2-hours of operating and maintenance training to the Owner's maintenance personnel. Training shall be provided at times convenient to the Owner. Approved Operating and Maintenance Manuals shall be available to the Owner prior to the training session.

B. Instructions and Drawings: Complete instructions, consisting of operating and maintenance manuals, parts book, dimensional drawings, separate unit wiring diagrams and schematics and interconnecting wiring diagrams shall be provided as part of the project operating and maintenance manuals.

3.7 IDENTIFICATION:

A. General: Refer to Owner existing, "Identification for Electrical Systems", for requirements concerning painting, nameplates, and labeling.

END OF SECTION

SECTION 26 36 00
AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes transfer switches rated 600 V and less, including the following:
   1. Service entranced rated automatic transfer switches.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified..

C. Qualification Data: For manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition, include the following:
   1. Features and operating sequences, both automatic and manual.
   2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than 8 hours from time of notification.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7 and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

C. Source Limitations: Obtain automatic transfer switches bypass/isolation switches nonautomatic and transfer switches through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 99.

H. Comply with NFPA 110.

I. Comply with UL 1008 unless requirements of these Specifications are stricter.

1.4 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with the requirements of this Section, provide products by one of the following:

1. Transfer Switches Using Molded-Case Switches or Circuit Breakers:

a. ASCO, Inc.

b. Caterpillar.

c. Or equal, compatible with Generator manufacturer.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30% of switch ampere rating, unless otherwise indicated.

B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2% or better over an operating temperature range of minus 20 to 70°C.

D. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

E. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism, mechanically and electrically interlocked in both directions.

F. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.

1. Switch Action: Double throw; mechanically held in both directions.

2. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.

G. Neutral Switching. Where 4-pole switches are indicated, provide neutral pole switched simultaneously with phase poles.

H. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for

oversize neutral shall be double the nominal rating of circuit in which switch is installed.

I. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

J. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, either by color-code or by numbered or lettered wire and cable tape markers at terminations. Color-coding and wire and cable tape markers are per manufacturer standards.

1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

K. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 SERVICE ENTRANCED RATED AND AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switching Arrangement: Double-throw type, incapable of pauses or intermediate position stops during normal functioning, unless otherwise indicated.

C. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

D. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.

E. Transfer Switches Based on Molded-Case-Switch Components: Comply with NEMA AB 1, UL 489, and UL 869A.

F. In-Phase Monitor: Factory-wired, internal relay controls transfer so it occurs only when the 2 sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 15 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70% or more of nominal voltage.

G. Programmed Neutral Switch Position: Switch operator has a programmed neutral position arranged to provide a midpoint between the 2 working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Pause is adjustable from 0.5-30 sec. minimum and factory set for 0.5 sec., unless otherwise indicated. Time delay occurs for both transfer directions. Pause is disabled unless both sources are live.

H. Automatic Transfer Switch Features:

1. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85-100% of nominal, and dropout voltage is adjustable from 75-98% of pickup value. Factory set for pickup at 90% and dropout at 85%.

2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from 0-6 sec., and factory set for 1 sec.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85-100% of nominal. Factory set for pickup at 90%. Pickup frequency shall be adjustable from 90-100% of nominal. Factory set for pickup at 95%.
4. Time Delay for Retransfer to Normal Source: Adjustable from 0-30 min., and factory set for 10 min. to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Test Switch: Simulate normal-source failure.
6. Switch-Position Pilot Lights: Indicate source to which load is connected.
7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
    a. Normal Power Supervision: Green light with nameplate engraved "NORMAL SOURCE AVAILABLE."
    b. Emergency Power Supervision: Red light with nameplate engraved "EMERGENCY SOURCE AVAILABLE."
8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240 Vac.
9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and 1 isolated and normally open; rated 10 A at 32 Vdc minimum.
11. Engine Shutdown Contacts: Time delay adjustable from 0-5 min., and factory set for 5 min. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7-30 days. Running periods are adjustable from 10-30 min. Factory settings are for 7 day exercise cycle, 20 min. running period, and 5 min. cool-down period. Exerciser features include the following:
    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is not available.

I. Service Entranced Rated Automatic Transfer Switches: For service entranced rated automatic transfer switches the following additional requirements shall apply:
1. Rated Less Than 1,000 A: Normal connection shall be provided with a thermal magnetic rated molded case circuit breaker with current ratings as shown on the Drawings. It shall have a thermal magnetic trip unit.
2. Rated Greater Than 1,000 A: Normal connection shall be provided with a stationary

mount, insulated case circuit breaker with a solid-trip unit. The trip unit shall have an adjustable long time, short time, instantaneous, and ground fault trip settings. The insulated case circuit breaker shall trip open when the ground fault setting is exceeded.

2.4 SOURCE QUALITY CONTROL

A. Factory test and inspect components, assembled switches, and associated equipment. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

2.5 ELECTRICAL CONTROL DEVICES

A. Per manufacturers recommendation

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor-Mounting Switch: Anchor to floor by bolting.
   1. Concrete Bases: Four inches high, reinforced, with chamfered edges. Extend base no more than 4 inches in all directions beyond the maximum dimensions of switch, unless otherwise indicated or unless required for seismic support.

B. Identify components according to owner standards.

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

3.2 CONNECTIONS

A. Ground equipment according to NEC Art. 250.

B. Connect wiring according manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: [OWNER will engage] [Engage] a qualified independent testing and inspecting agency to perform tests and inspections and prepare test reports.

B. manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

C. Perform tests and inspections and prepare test reports.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
   2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
   3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages

and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.

b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.

c. Verify that manual transfer warnings are properly placed.

d. Perform manual transfer operation.

5. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least 3 times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.

b. Simulate loss of phase-to-ground voltage for each phase of normal source.

c. Verify time-delay settings.

d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

7. Verify grounding connections and locations and ratings of sensors.

D. Testing Agency's Tests and Inspections:

1. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.

a. Check for electrical continuity of circuits and for short circuits.

b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.

c. Verify that manual transfer warnings are properly placed.

d. Perform manual transfer operation.

4. After energizing circuits, demonstrate interlocking sequence and operational function for each switch at least 3 times.

a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.

b. Simulate loss of phase-to-ground voltage for each phase of normal source.

c. Verify time-delay settings.

d. Verify pickup and dropout voltages by data readout or inspection of control settings.

e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.

f. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

E. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

1. Verify grounding connections and locations and ratings of sensors.

F. Coordinate tests with tests of generator and run them concurrently.

G. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

H. Remove and replace malfunctioning units and retest as specified above.

I. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train OWNER's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment as specified below.

B. Coordinate this training with that for generator equipment.