



**OREGON STATE UNIVERSITY
REQUEST FOR QUOTE (RFQ)**

		ISSUE DATE:	November 4th, 2014		
RFQ #	ML173291Q	RFQ DUE DATE:	November 19th, 2014 @2:00 PM		
DELIVER TO:		REQUESTED BY / RETURN QUOTE TO:			
DEPARTMENT:	Facilities Services	NAME:	Mark Lessel		
ADDRESS:	560 SW 15th St.	E-MAIL:	Mark.lessel@oregonstate.edu		
CITY, STATE ZIP:	Corvallis, OR 97331	TELEPHONE:	541-737-3667		
REQUIRED DELIVERY DATE:	1-10-2015	FAX:	541-737-2170		
ITEM	DESCRIPTION	QTY	UNIT	UNIT PRICE	TOTAL PRICE
1	250kw Generator 120/208v Per Attachment # A Diesel Generator Sets	1	Ea		
2	Automatic Transfer Switches 3-Pole Per Attachment # B	1	Ea		
3	AO40X126 Cummings PowerCommand 500 LAN, Remote Monitoring System, with Programing, or approved alternate.	1	ea		
	Verification of factory Authorized Service Center. 24/7 service coverage. Provide Contact Number				
	SHIPPING COSTS MUST BE ADDED TO ITEMS				
Delivery is f.o.b. destination, prepaid and allowed. Shipping, freight and handling must be included in quoted prices. Additional costs for such are disallowed.				TOTAL	
DELIVERY TIME AFTER RECEIPT OF ORDER:		PRICES VALID THROUGH:			
SPECIAL INSTRUCTIONS:		VENDOR INFORMATION:			
<p>1. Unless otherwise specified, all items quoted are to be new, unused and not remanufactured in any way.</p> <p>2. Brand names are for the purpose of describing and establishing the characteristics desired and are not intended to limit or restrict competition. Quoters may submit quotes for substantially equivalent products unless the RFQ provides that a specific brand is necessary because of compatibility requirements, etc. All such brand substitutions shall be subject to approval by OSU.</p> <p>3. Quoters must clearly identify all products quoted. Brand name and model or number must be shown.</p> <p>4. Only documents issued as addenda by OSU serve to change the RFQ in any way.</p> <p>5. OSU reserves the right to make the award by item, partial or whole lots, groups of items or entire quote, whichever is in the best interest of OSU.</p> <p>6. OSU may reject any Quote not in compliance with the RFQ, attachments, and addenda, or if it is in the best interest of OSU.</p>		COMPANY:			
		ADDRESS:			
		CITY, STATE, ZIP:			
		CONTACT NAME:			
		E-MAIL:			
		TELEPHONE:			
FAX:					
		VENDOR SIGNATURE:			
		By signature below the undersigned certifies that they are authorized to act on behalf of the quoter and will comply with all aspects of the quote herein.			
		SIGNATURE:			
		NAME/TITLE:			

This procurement is subject to the indicated Oregon State University Standard Terms and Conditions for: Goods Services Purchase Order Construction Software. The indicated terms and conditions may be viewed at <http://pacs.oregonstate.edu/terms-and-conditions>

Attachment A

Diesel Generator Sets

Architectural Format

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes packaged engine-generator sets suitable for use in mission critical applications with the features as specified and indicated. Engine generators will be used as the Standby power source for the system, but shall be capable of providing reliable power with no run-time limitations while the primary source of power is unavailable.

1.3 DEFINITIONS

- A. Emergency Standby Power (ESP): Per ISO 8528: The maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a utility power outage or under test conditions for up to 200 hours of operation per year with the maintenance intervals and procedures being carried out as prescribed by the manufacturers. The permissible average power output (Ppp) over 24 hours of operation shall not exceed 70 percent of the ESP unless otherwise agreed by the RIC engine manufacturer.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
 - 1. Thermal damage curve for generator.
 - 2. Time-current characteristic curves for generator protective device.
 - 3. Sound test data, based on a free field requirement. Actual factory test calculated values are not acceptable.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Wiring Diagrams: Control interconnection, Customer connections.

C. Certifications:

1. Submit statement of compliance which states the proposed product(s) is certified to the emissions standards required by the location for EPA, stationary emergency application.
2. Submit statement of compliance which states the proposed product(s) are seismically certified in compliance with local requirements signed and sealed by a qualified professional engineer.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Seismic Qualification Certification: Submit certification that the 24 Hour(s) fuel tank, the Sound Attenuated enclosure, engine-generator set, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Source quality-control test reports.

1. Certified summary of prototype-unit test report. See requirements in Part 2 "Source Quality Control" Article Part A. Include statement indicating torsional compatibility of components.
2. Certified Test Report: Provide certified test report documenting factory test per the requirements of this specification, as well as certified factory test of generator set sensors per NFPA110 level 1.
3. List of factory tests to be performed on units to be shipped for this Project.
4. Report of exhaust emissions and compliance statement certifying compliance with applicable regulations.

C. Warranty:

1. Submit manufacturer's warranty statement to be provided for this Project.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- C. Comply with NFPA 37 (Standard For the Installation and Use of Stationary Combustion Engines and Gas Turbines).
- D. Comply with NFPA 70 (National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702).
- E. Comply with NFPA 110 (Emergency and Standby Power Systems) requirements for Level 1 emergency power supply system.
- F. Comply with UL 2200.
- G. Noise Emission: Comply with local codes for maximum noise level at 71 dba @ 23' due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: 32.0 deg F to 100.0 deg F.
 - 2. Relative Humidity: See location for details.
 - 3. Altitude: Sea level to 500.0 feet (152.4 m).

1.8 WARRANTY

- A. Base Warranty: Manufacturer shall provide base warranty coverage on the material and workmanship of the generator set for a minimum of twenty-four (24) months for Standby product and twelve (12) months for Prime/Continuous product from registered commissioning and start-up.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: The basis for this specification is Cummins Power Generation equipment, approved equals may be considered if equipment performance is shown to meet the requirements herein.

2.2 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.
- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
 - 1. Rigging Information: Indicate location of each lifting attachment, generator-set center of gravity, and total package weight in submittal drawings.
- C. Capacities and Characteristics:
 - 1. Power Output Ratings: Electrical output power rating for Standby operation of not less than 250.0kW, at 80 percent lagging power factor, 120/208, Parallel Wye, Three phase, 4-wire, 60 hertz.
 - 2. Alternator shall be capable of accepting maximum 1372.0 kVA in a single step and be capable of recovering to a minimum of 90% of rated no load voltage. Following the application of the specified kVA load at near zero power factor applied to the generator set.
 - 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component. The engine-generator nameplate shall include information of the power output rating of the equipment.
- D. Generator-Set Performance:
 - 1. Steady-State Voltage Operational Bandwidth: 0.5 percent of rated output voltage from no load to full load.
 - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable voltage within 10 seconds.
 - 3. Steady-State Frequency Operational Bandwidth: 0.25 percent of rated frequency from no load to full load.
 - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 - 5. Transient Frequency Performance: Not more than 15 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within 5 seconds. On application of a 100% load step the generator set shall recover to stable frequency within 10 seconds.

6. Output Waveform: At full load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 8 seconds without damage to generator system components. For a 1-phase, bolted short circuit at system output terminals, system shall regulate both voltage and current to prevent over-voltage conditions on the non-faulted phases.
8. Start Time: Comply with NFPA 110, Level 1, Type 10, system requirements.
9. Ambient Condition Performance: Engine generator shall be designed to allow operation at full rated load in an ambient temperature under site conditions, based on highest ambient condition. Ambient temperature shall be as measured at the air inlet to the engine generator for enclosed units, and at the control of the engine generator for machines installed in equipment rooms.
10. Noise Output: Engine generator shall be tested by the manufacturer per ANSI S12.34. Data documenting performance shall be provided with submittal documentation.

2.3 ENGINE

- A. Fuel: ASTM D975 #2 Diesel Fuel
- B. Rated Engine Speed: 1800RPM.
- C. Lubrication System: The following items are mounted on engine or skid:
 1. Lube oil pump: shall be positive displacement, mechanical, full pressure pump.
 2. Filter and Strainer: Provided by the engine manufacturer of record to provide adequate filtration for the prime mover to be used.
 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Engine Fuel System: The engine fuel system shall be installed in strict compliance to the engine manufacturer's instructions
- E. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
- F. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity and performance.

1. Designed for operation on a single 208 VAC, Single phase, 60Hz power connection. Heater voltage shall be shown on the project drawings.
 2. Installed with isolation valves to isolate the heater for replacement of the element without draining the engine cooling system or significant coolant loss.
 3. Provided with a 24VDC thermostat, installed at the engine thermostat housing
- G. Governor: Adjustable isochronous, with speed sensing. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate as appropriate to the state of the engine generator. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed, and operating in various isochronous states.
- H. Cooling System: Closed loop, liquid cooled
1. The generator set manufacturer shall provide prototype test data for the specific hardware proposed demonstrating that the machine will operate at rated standby load in an outdoor ambient condition of 40 deg C.
 2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 3. Size of Radiator overflow tank: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 4. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 5. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 6. Duct Flange: Generator sets installed indoors shall be provided with a flexible radiator duct adapter flange.
- I. Muffler/Silencer: Selected with performance as required to meet sound requirements of the application, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements. For generator sets with outdoor enclosures the silencer shall be inside the enclosure.
- J. Air-Intake Filter: Engine-mounted air cleaner with replaceable dry-filter element and restriction indicator.
- K. Starting System: 12 or 24V, as recommended by the engine manufacturer; electric, with negative ground.

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
2. Cranking Cycle: As required by NFPA 110 for level 1 systems.
3. Battery Cable: Size as recommended by engine manufacturer for cable length as required. Include required interconnecting conductors and connection accessories.
4. Battery Compartment: Factory fabricated of metal with acid-resistant finish.
5. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation. The battery charging alternator shall have sufficient capacity to recharge the batteries with all parasitic loads connected within 4 hours after a normal engine starting sequence.
6. Battery Chargers: Unit shall comply with UL 1236, provide fully regulated, constant voltage, current limited, battery charger for each battery bank. It will include the following features:
 - a. Operation: Equalizing-charging rate based on generator set manufacturer's recommendations shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 20 deg C to plus 40 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - d. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - e. Provide LED indication of general charger condition, including charging, faults, and modes. Provide a LCD display to indicate charge rate and battery voltage. Charger shall provide relay contacts for fault conditions as required by NFPA110.
 - f. Enclosure and Mounting: NEMA, Type 1, wall-mounted cabinet.

2.4 FUEL OIL STORAGE

- A. Comply with NFPA 30.

- B. Sub Base-Mounted Fuel Oil Tank: Provide a double wall secondary containment type sub base fuel storage tank. The tank shall be constructed of corrosion resistant steel and shall be UL 142 listed and labeled. The fuel tank shall include the following features:
1. Capacity: Fuel for 24 Hour(s) continuous operation at 100 percent rated power output.
 2. Tank rails and lifting eyes shall be rated for the full dry weight of the tank, genset, and enclosure.
 3. Electrical stub up(s)
 4. Normal & emergency vents
 5. Lockable fuel fill
 6. Mechanical fuel level gauge
 7. High and low level switches to indicate fuel level
 8. Leak detector switch
 9. Sub base tank shall include a welded steel containment basin, sized at a minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a tank rupture.
 10. Tank design shall meet the regional requirements for the Project location

2.5 CONTROL AND MONITORING

- A. Engine generator control shall be microprocessor based and provide automatic starting, monitoring, protection and control functions for the unit.
- B. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of generator set. When mode-selector switch is switched to the on position, generator set starts. The off position of same switch initiates generator-set shutdown. (Switches with different configurations but equal functions are acceptable.) When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.
- C. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts generator set. The off position of same switch initiates generator-set shutdown. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of the local (generator set-mounted) and/or remote emergency-stop switch also shuts down generator set.

- D. Configuration: Operating and safety indications, protective devices, system controls, engine gages and associated equipment shall be grouped in a common control and monitoring panel. Mounting method shall isolate the control panel from generator-set vibration. AC output power circuit breakers and other output power equipment shall not be mounted in the control enclosure.
- E. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following: AC meters shall be both digital and analog for Volts, current, KW Power factor and frequency, analog meters shall be coded green for normal operation, amber for warning levels and red for shutdown conditions
1. AC voltmeter (3-phase, line to line and line to neutral values).
 2. AC ammeter (3-phases).
 3. AC frequency meter.
 4. AC kW output (total and for each phase). Display shall indicate power flow direction.
 5. AC kVA output (total and for each phase). Display shall indicate power flow direction.
 6. AC Power factor (total and for each phase). Display shall indicate leading or lagging condition.
 7. Ammeter-voltmeter displays shall simultaneously display conditions for all three phases.
 8. Emergency Stop Switch: Switch shall be a red "mushroom head" pushbutton device complete with lock-out/tag-out provisions. Depressing switch shall cause the generator set to immediately stop the generator set and prevent it from operating.
 9. Fault Reset Switch: Supply a dedicated control switch to reset/clear fault conditions.
 10. DC voltmeter (alternator battery charging).
 11. Engine-coolant temperature gauge.
 12. Engine lubricating-oil pressure gauge.
 13. Running-time meter.
 14. Generator-voltage and frequency digital raise/lower switches. Rheostats for these functions are not acceptable. The control shall adjustment of these parameters in a range of plus or minus 5% of the voltage and frequency operating set point (not nominal voltage and frequency values.) The voltage and frequency adjustment functions shall be disabled when the paralleling breaker is closed.
 15. Fuel tank derangement alarm.

16. AC Protective Equipment: The control system shall include over/under voltage, reverse kVAR, reverse kW, over load (kW) short circuit, over current, loss of voltage reference, and over excitation shut down protection. There shall be a ground fault alarm for generator sets rated over 1000 amps, overload warning, and overcurrent warning alarm.
 17. Status LED indicating lamps to indicate remote start signal present at the control, existing shutdown condition, existing alarm condition, not in auto, and generator set running.
 18. A graphical display panel with appropriate navigation devices shall be provided to view all information noted above, as well as all engine status and alarm/shutdown conditions (including those from an integrated engine emission control system). The display shall also include integrated provisions for adjustment of the gain and stability settings for the governing and voltage regulation systems.
 19. Panel lighting system to allow viewing and operation of the control when the generator room or enclosure is not lighted.
 20. Data Logging: The control system shall log the latest 20 different alarm and shut down conditions, the total number of times each alarm or shutdown has occurred, and the date and time the latest of these shutdown and fault conditions occurred.
 21. DC control Power Monitoring: The control system shall continuously monitor DC power supply to the control, and annunciate low or high voltage conditions. It shall also provide an alarm indicating imminent failure of the battery bank based on degraded voltage recover on loading (engine cranking).
- F. PowerCommand 500 Remote monitoring System shall be supplied this system shall allow users to monitor their generator set data, such as annunciator , alternator and engine data.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator Overcurrent Protection: The generator set shall be provided with a UL Listed/CSA Certified protective device that is coordinated with the alternator provided to prevent damage to the generator set on any possible overload or overcurrent condition external to the machine. The protective device shall be listed as a utility grade protective device under UL category NRGU. The control system shall be subject to UL follow-up service at the manufacturing location to verify that the protective system is fully operational as manufactured. Protector shall perform the following functions:
1. Initiates a generator kW overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
 2. Under single phase or multiple phase fault conditions, or on overload conditions, indicates an alarm conditions when the current flow is in excess of 110% of rated current for more than 10 seconds.

3. Under single phase or multiple phase fault conditions, operates to switch off alternator excitation at the appropriate time to prevent damage to the alternator.
4. The operator panel shall indicate the nature of the fault condition as either a short circuit or an overload.
5. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot greater than 120% of nominal voltage.
6. The protective system provided shall not include an instantaneous trip function.

2.7 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H
- D. Temperature Rise: 80 / Class B environment.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, over speed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Permanent Magnet Generator (PMG) shall provide excitation power for optimum motor starting and short circuit performance.
- G. Enclosure: Drip-proof.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified. The voltage regulation system shall be microprocessor-controlled, 3-phase true RMS sensing, full wave rectified, and provide a pulse-width modulated signal to the exciter. No exceptions or deviations to these requirements will be permitted.
- I. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- J. Subtransient Reactance: 12 percent maximum, based on the rating of the engine generator set.

2.8 OUTDOOR GENERATOR-SET ENCLOSURE

- A. Description: Sound Attenuated Steel housing. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Instruments, control, and battery system shall be mounted within enclosure.
- B. Construction:
 1. Louvers: Equipped with bird screen to permit air circulation when engine is not running while excluding birds and rodents.

2. Hinged Doors: With padlocking provisions. Restraint/Hold back hardware to prevent door to keep door open at 180 degrees during maintenance. Rain lips over all doors.
 3. Exhaust System:
 - a. Muffler Location: Within enclosure.
 4. Hardware: All hardware and hinges shall be stainless steel.
 5. Wind Rating: Wind rating shall be 150 mph
 6. Mounting Base: Suitable for mounting on sub-base fuel tank or housekeeping pad.
 7. A weather protective enclosure shall be provided which allows the generator set to operate at full rated load with a static pressure drop equal to or less than 0.5 inches of water.
 8. Inlet ducts shall include rain hoods
- C. Engine Cooling Airflow through Enclosure: Housing shall provide ample airflow for engine generator operation at rated load in an ambient temperature of 40 deg C.
1. Louvers: Fixed-engine, cooling-air inlet and discharge.
 2. Motorized Louvers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating. Dampers shall be of a "fail open" design to allow airflow in the event of failure
- D. Sound Performance: Reduce the sound level of the engine generator while operating at full rated load to a maximum of 71 dBA measured at any location 7 m from the engine generator in a free field environment.
- E. Electrical Provisions
1. Compliance with NEC: Package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing.
 2. External Electrical Connections: All power and control interconnections shall be made within the perimeter of the enclosure.
- F. Site Provisions:
1. Lifting: Complete assembly of engine generator, enclosure, and sub base fuel tank (when used) shall be designed to be lifted into place as a single unit, using spreader bars.

2.9 VIBRATION ISOLATION DEVICES

- A. Vibration Isolation: Generators installed on grade shall be provided with elastomeric isolator pads integral to the generator, unless the engine manufacturer requires use of spring isolation.

2.10 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Powder-coated and baked over corrosion-resistant pretreatment and compatible primer. Manufacturer's standard color or as directed on the drawings.

2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 - 1. Tests: Comply with NFPA 110, Level 1 Energy Converters. In addition, the equipment engine, skid, cooling system, and alternator shall have been subjected to actual prototype tests to validate the capability of the design under the abnormal conditions noted in NFPA110. Calculations and testing on similar equipment which are allowed under NFPA110 are not sufficient to meet this requirement.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 - 1. Test engine generator set manufactured for this Project to demonstrate compatibility and functionality.
 - 2. Full load run.
 - 3. Maximum power.
 - 4. Voltage regulation.
 - 5. Steady-state governing.
 - 6. Single-step load pickup.
 - 7. Simulated safety shutdowns.
 - 8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation, application, and alignment instructions and with NFPA 110.
- B. Equipment shall be installed by the contractor in accordance with final submittals and contract documents. Installation shall comply with applicable state and local codes as

- required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.
- C. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required), under the supervision of the equipment supplier.
 - D. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.
 - E. Equipment shall be initially started and operated by representatives of the manufacturer. All protective settings shall be adjusted as instructed by the consulting engineer.
 - F. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to initial operation and final testing of the system.
 - G. On completion of the installation by the electrical contractor, the generator set supplier shall conduct a site evaluation to verify that the equipment is installed per manufacturer's recommended practice.

3.2 ON-SITE ACCEPTANCE TEST

- A. The complete installation shall be tested to verify compliance with the performance requirements of this specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified in advance and shall have the option to witness the tests. The generator set manufacturer shall provide a site test specification covering the entire system. Tests shall include:
 - B. Prior to start of active testing, all field connections for wiring, power conductors, and bus bar connections shall be checked for proper tightening torque.
 - C. Installation acceptance tests to be conducted on site shall include a "cold start" test, a two hour full load (resistive) test, and a one-step rated load pickup test in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test, if necessary.
 - D. Perform a power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.3 TRAINING

- A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

END OF SECTION

Attachment B

AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:

1. Automatic transfer switches
2. Remote annunciation systems

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
 1. Technical data on all major components of all transfer switches and other products described in this section. Data is required for the transfer switch mechanism, control system, cabinet, and protective devices specifically listed for use with each transfer switch. Include steady state and fault current ratings, weights, operating characteristics, and furnished specialties and accessories.
 2. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
- 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.
 1. Dimensioned outline drawings of assembly, including elevations, sections, and details including minimal clearances, conductor entry provisions, gutter space, installed features and devices and material lists for each switch specified.
 2. Internal electrical wiring and control drawings.
 3. Interconnection wiring diagrams, showing recommended conduit runs and point-to-point terminal connections to generator set.
 4. Installation and mounting instructions, including information for proper installation of equipment to meet seismic requirements.

C. Manufacturer Seismic Qualification Certification: Submit certification that transfer switches accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Seismic certification, as required for site conditions. Seismic certifications shall be third-party certified, and based on testing. Certification based on calculations does not meet this requirement.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational both during and after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements. Coordinate paragraph below with qualification requirements in Division 01 Section "Quality Requirements" and as supplemented in "Quality Assurance" Article.

D. Manufacturer and Supplier Qualification Data

1. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.
2. The manufacturer of this equipment shall have produced similar equipment for a minimum period of 10 years. When requested, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Features and operating sequences, both automatic and manual.
2. List of all factory settings of relays, timers and protective devices; provide setting and calibration instructions where applicable.

F. Warranty documents demonstrating compliance with the project's contract requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: The equipment supplier shall maintain a service center capable of providing training, parts, maintenance and emergency repairs to equipment, including transfer switch generator sets and remote monitoring equipment (if applicable) at the site within a response period of less than (eight hours or appropriate time period designated for Project) from time of notification.

1. The transfer switch shall be serviced by technicians employed by, and specially trained and certified by, the generator set supplier and the supplier shall have a service organization that is factory-certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year.
 2. Submit names, experience level, training certifications, and locations for technicians that will be responsible for servicing equipment at this site.
 3. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.
- B. Source Limitations: All transfer switches are to be obtained through one source from a single manufacturer. The generator set manufacturer shall warrant transfer switches to provide a single source of responsibility for products provided.
- C. 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 as suitable for use in emergency, legally required or optional standby use as appropriate for the connected load.
- D. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:
1. Transfer switches and enclosures shall be UL 1008 listed and labeled as suitable for use in emergency, legally required, and optional standby applications.
 2. CSA 282, Emergency Electrical Power Supply for Buildings, and CSA C22.2, No. 14-M91 Industrial Control Equipment
 3. NFPA 70, National Electrical Code. Equipment shall be suitable for use in systems in compliance with Articles 700, 701 and 702.
 4. Comply with NEMA ICS 10-1993 AC Automatic Transfer Switches
 5. IBC 2012 – The transfer switch(es) shall be prototype-tested and third-party certified to comply with the requirements of IBC group III or IV, Category D/F. The equipment shall be shipped with the installation instructions necessary to attain installation compliance.
 6. IEEE 446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 7. EN55011, Class B Radiated Emissions and Class B Conducted Emissions
 8. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity
 9. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity

10. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
 11. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
 12. IEC 1000-4-6 Conducted Field Immunity
 13. IEC 1000-4-11 Voltage Dip Immunity
 14. IEEE 62.41, AC Voltage Surge Immunity
 15. IEEE 62.45, AC Voltage Surge Testing
- E. Comply with NFPA 99 – Essential Electrical Systems for Healthcare Facilities
- F. Comply with NFPA 110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems, regardless of the actual circuit level.
- G. The manufacturer shall warrant the material and workmanship of the transfer switch equipment for a minimum of two (2) year from the warranty start date. The warranty start date is the date of registered commissioning and start up or eighteen (18) months from date of shipment, whichever is sooner.

1.5 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
1. Notify (Architect/Construction Manager/Owner) no fewer than (insert appropriate number) days in advance of proposed interruption of electrical service.
 2. Do not proceed with interruption of electrical service without (Architect/Construction Manager/Owner's) written permission.
 3. Do not energize any new service or distribution equipment without notification and permission of the (Architect/Construction Manager/Owner).

1.6 COORDINATION

- A. Size and location of concrete bases and anchor bolt inserts shall be coordinated. Concrete, reinforcement and formwork must meet the requirements specified in Division 03. See section "INSTALLATION" for additional information on installation
- B. If Project calls for bypass switch(es) mounted on a concrete base, the base must be designed to accommodate the requirements of the drawout mechanism (extension rails and/or wheeled carriage) of the bypass switch.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cummins Power Generation, or approved alternate.
- B. Equipment specifications for this Project are based on automatic transfer switches manufactured by Cummins Power Generation. Switches manufactured by Russelectric or ASCO that meet the requirements of this specification are acceptable. Proposals must include a line-by-line compliance statement based on this specification.
- C. Transfer switches utilizing molded case circuit breakers do not meet the requirements of this specification and will not be accepted.

2.2 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Provide transfer switches in the number and ratings that are shown on the drawings.
- B. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.
- C. Fault-Current Closing and Withstand Ratings: UL 1008 WCR ratings must be specifically listed as meeting the requirements for use with protective devices at installation locations, under specified fault conditions. Withstand and closing ratings shall be based on use of the same set of contacts for the withstand test and the closing test.
- D. Solid-State Controls: All settings should be accurate to +/- 2% or better over an operating temperature range of - 40 to + 60 degrees C (- 40 to + 140 degrees F).
- E. 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.
- F. Electrical Operation: Accomplished by a non-fused, momentarily energized solenoid or electric motor operator mechanism, mechanically and electrically interlocked in both directions (except that mechanical interlock is not required for closed transition switches).
- G. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Switches using molded-case switches or circuit breakers, or insulated case circuit breaker components are not acceptable.
 - 2. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the Source 1 and Source 2 positions.
 - 3. Main switch contacts shall be high pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.

4. Contacts shall be operated by a high-speed electrical mechanism that causes contacts to open or close within three electrical cycles from signal.
 5. The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function.
 6. Transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation but prevent direct contact with components that could be operating at line voltage levels.
 7. The transfer switch shall include the mechanical and control provisions necessary to allow the device to be field-configured for operating speed. Transfer switch operation with motor loads shall be as is recommended in NEMA MG1.
 - a. Phase angle monitoring/timing equipment is not an acceptable substitute for this functionality
- H. Factory wiring: Transfer switch internal wiring shall be composed of pre-manufactured harnesses that are permanently marked for source and destination. Harnesses shall be connected to the control system by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism
- I. Terminals: Terminals shall be pressure type and appropriate for all field wiring. Control wiring shall be equipped with suitable lugs, for connection to terminal strips.
- J. Enclosures: All enclosures shall be third-party certified for compliance to NEMA ICS 6 and UL 508, unless otherwise indicated:
1. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70, regardless of the direction from which the conduit enters the enclosure.
 2. Exterior cabinet doors shall provide complete protection for the system's internal components. Doors must have permanently mounted key-type latches. Bolted covers or doors are not acceptable.
 3. Transfer switches shall be provided in enclosures that are third party certified for their intended environment per NEMA requirements.
 - a. Transfer switches mounted in a controlled indoor environment shall be provided in NEMA Type 1 enclosures (IEC type IP30).

2.3 AUTOMATIC TRANSFER SWITCHES

- A. Comply with requirements for Level 1 equipment according to NFPA 110.

B. Indicated current ratings:

1. Refer to the Project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, number of poles, voltage and ampere ratings, enclosure type, and accessories.
2. Main contacts shall be rated for 600 VAC minimum.
3. Transfer switches shall be rated to carry 100% of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C (-40 to +140 degrees F), relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000 meters).

C. Manual Switch Operation: The power transfer mechanism shall include provisions for manual operation under load with the enclosure door closed. Manual operation may be electromechanical or mechanical, but must be coordinated with control function

D. Relay Signal: Control shall include provisions for addition of a pre-transfer relay signal, adjustable from 0 to 60 seconds, to be provided if necessary for elevator operation, based on equipment provided for the project.

E. Transfer switches that are designated on the drawings as 3-pole shall be provided with a neutral bus and lugs. The neutral bus shall be sized to carry 100% of the current designated on the switch rating.

F. Automatic Transfer Switch Control Features

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600 VAC. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. All transfer switch sensing shall be configurable from an operator panel or from a Windows XP or later PC-based service tool. Designs utilizing DIP switches or other electromechanical devices are not acceptable.
3. The transfer switch shall be configurable to accept a relay contact signal and a network signal from an external device to prevent transfer to the generator service.
4. The transfer switch shall provide a relay contact signal prior to transfer or re-transfer. The time period before and after transfer shall be adjustable in a range of 0 to 60 seconds.
5. The control system shall be designed and prototype tested for operation in ambient temperatures from - 40 degrees C to + 60 degrees C (- 40 to +140 degrees F). It shall be designed and tested to comply with the requirements of the noted voltage and RFI/EMI standards.

6. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.
 7. The indicator panel LEDs shall display:
 - a. Which source the load is connected to (Source 1 or Source 2)
 - b. Which source or sources are available
 8. The indicator shall have pushbuttons that allow the operator to activate the following functions:
 - a. Activate pre-programmed test sequence
 - b. Override programmed delays, and immediately go to the next operation
 - c. Reset the control by clearing any faults
 - d. Test all of the LEDs by lighting them simultaneously
- G. Transfer Switch Control Panel: The transfer switch shall have a microprocessor-based control with a sealed membrane panel incorporating pushbuttons for operator-controlled functions, and LED lamps for system status indicators. Panel display and indicating lamps shall include permanent labels.
- H. Control Functions: Functions managed by the control shall include:
1. Software adjustable time delays:
 - a. Engine start (prevents nuisance genset starts in the event of momentary power fluctuation): 0 to 120 seconds (default 3 sec)
 - b. Transfer normal to emergency (allows genset to stabilize before load is transferred): 0 to 120 seconds (default 3 sec)
 - c. Re-transfer emergency to normal (allows utility to stabilize before load is transferred from genset): 0 to 30 minutes (default 3 sec)
 - d. Engine cooldown: 0 to 30 minutes (default 10 min)
 - e. Programmed transition: 0 to 60 seconds (default 3 sec)
 2. Undervoltage sensing: three-phase normal, single phase emergency source.

- a. Pickup: 85 to 98% of nominal voltage (default 90%)
 - b. Dropout: 75 to 98% of nominal voltage (default 90%)
 - c. Dropout time delay: 0.1 to 1.0 seconds (default 0.5 sec)
 - d. Accurate to within +/- 2% of nominal voltage
3. Over-voltage sensing: three-phase normal, single-phase emergency source.
 - a. Pickup: 95 to 99% of dropout setting (default 95%)
 - b. Dropout: 105 to 135% of nominal voltage (default 110%)
 - c. Dropout time delay: 0.5 to 120 seconds (default 3 sec)
 - d. Accurate to within +/- 2% of nominal voltage
 4. Over/under frequency sensing:
 - a. Pickup: +/- 5 to +/-20% of nominal frequency (default 10%)
 - b. Dropout: +/-1% beyond pickup (default 1%)
 - c. Dropout time delay: 0.1 to 15.0 seconds (default 5 sec)
 - d. Accurate to within +/- 0.05 Hz
 5. Voltage imbalance sensing:
 - a. Dropout: 2 to 10% (default 4%)
 - b. Pickup: 90% of dropout
 - c. Time delay: 2.0 to 20 seconds (default 5 sec)

I. Control features shall include:

1. Programmable genset exerciser: A field-programmable control shall periodically start and run the generator with or without transferring the load for a preset time period, then re-transfer and shut down the generator after a preset cool-down period.
2. In event of a loss of power to the control, all control settings, real-time clock setting and the engine start-time delay setting will be retained.
3. The system continuously logs information including the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. An event recorder stores information, including time and date-stamp, for up to 50 events.

4. Re-Transfer Inhibit Switch: Inhibits automatic re-transfer control so automatic transfer switch will remain connected to emergency power source as long as it is available regardless of condition of normal source.

J. Control Interface

1. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.

K. Engine Starting Contacts

1. One isolated and normally closed pair of contacts rated 10A at 32 VDC minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Provide certification of IBC Seismic compliance

3.2 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
- C. Transfer switch shall be provided with AL/CU mechanical lugs sized to accept the full output rating of the switch. Lugs shall be suitable for the number and size of conductors shown on the drawings.
- D. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 SOURCE QUALITY CONTROL

- A. Prior to shipping, factory shall test and inspect components, assembled switches, and associated equipment to ensure proper operation.
- B. Factory shall check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements.
- C. Factory shall perform dielectric strength test complying with NEMA ICS 1.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: The supplier of the transfer switch(es) and associated equipment shall inspect, test, and adjust components, assemblies, and equipment installations, including connections, and report results in writing.
- B. Manufacturer's representative shall perform tests and inspections and prepare test reports.
- C. After installing equipment and after electrical circuitry has been energized, installer shall test for compliance with requirements.
 - 1. Perform recommended installation tests as recommended in manufacturer's installation and service manuals.
 - 2. After energizing circuits, demonstrate interlocking sequence and operational function for each switch.
 - a. Simulate power failures of normal source to automatic transfer switches and of emergency source with normal source available.
 - b. Verify time-delay settings.
 - c. Verify that the transfer switch is accurately metering AC voltage.
 - d. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
 - e. 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.

3.5 DEMONSTRATION

- A. After generator set installation, the generator and transfer switch supplier shall conduct a complete operation, basic maintenance, and emergency service seminar covering generator set and transfer switch equipment, for up to 10 people employed by the Owner.

1. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures.
2. The class duration shall be at least 1 hour in length, and include practical operation with the installed equipment.