BID REQUEST
Pre-Purchase of Emergency Generator
Bid Number # CL16-HT-0037

Introduction
The University of Massachusetts Lowell (UML) invites bids on the purchase of an Emergency Generator for North Quad Infrastructure.

Bid Specifications
1. Please see Technical Specifications Section 263213-Engine Generators, Section 263214-Installation of Engine Generators, Section 263600 Transfer Switches and North Quad Drawings.

Bid Rejection
The University reserves the right to reject any or all bids received in whole or in part if it is deemed such action is in the best interest of The University and the Commonwealth of Massachusetts.

Preparation of Bids
Bids must be signed, where instructed. Bidders are cautioned that errors, alterations, or corrections on the submitted bid must be initialed by the person signing the bid proposal or his/her authorized designee. Failure to do so may result in rejection of the bid for those items erased, altered, or corrected and not initialed. Telephone and or Fax bids will not be accepted.

Selection Criteria
UML shall enter into an agreement with the Bidder who submits the proposal that meets the minimum requirements, proof of quality and performance of previous work, ability to meet the time frame set by the University, is financially beneficial to UML and demonstrated ability to service the product in a timely and satisfactory manner.

Prevailing Wage Law
All services solicited through this RFB are subject to the Massachusetts Prevailing Wage Laws. A list is provided as part of the RFB indicating the trades for which a contractor is mandated by law to pay the prevailing wage rates. Applicable Prevailing Wage Rates are issued with this RFB and will become a part of any Contract resulting from this solicitation. It is the responsibility of the Contractor to adhere to the Prevailing Wage Laws. All Electrical Connections must be done by a Licensed Electrical Contractor. It is
the responsibility of the Vendor to obtain a City of Lowell Electrical Permit. The Vendor is also responsible for the Cost of any and all necessary permits.

**Certification of Tax Status**

Pursuant to Massachusetts General Law, Chapter 62C, Section 49 A, the bidder certifies under penalties of perjury that to the best of the bidder's knowledge and belief, they have filed all state tax returns and paid all state taxes required by law.

**Certification of Non-Collusion**

Pursuant to Massachusetts General Law, Chapter 7, Section 22 (20), the bidder certifies under penalties of perjury that their bid is in all respects bona fide, fair, and made without collusion or fraud with any person, joint venture, partnership, corporation or other business or legal entity.

**Bidder's Representations**

Each bidder by submitting its bid represents that:

a) The bid document and specifications have been read and understood by the bidder,
b) The bid is based upon the items described in the bidding documents and specifications without exceptions,
c) The bid has been arrived at independently and is submitted without collusion,

**Bid Documents**

Proposal may be submitted via email to Purchasing@uml.edu or hard copy sent to Purchasing at the address below.

**Bid Opening**

Bids will be opened and publicly read on, **Monday, December 14, 2015 at 11:00 AM EST**

at the Purchasing Department:

_Wannalancit Business Center_  
600 Suffolk St. Rm 415  
Lowell, MA  01854

It is vital that bids be in the Purchasing Office by the due date and time.

Late bids will not be considered, and will be placed, unopened, in the bid file.

We strongly encourage you to contact the Purchasing Office by telephone or e-mail prior to the bid opening to confirm that your bid has been received by the Purchasing Department. The general Purchasing Office phone number is (978) 934-3500 or email address is Purchasing@uml.edu. All communication should reference RFB No. CL16-HT-0037.
Questions/Contact Person

Prospective Bidders may submit questions to UML regarding this solicitation via email to Purchasing@uml.edu

Amendments

The Purchasing Department reserves the right to amend, alter, or cancel the bid at any time prior to the deadline for submissions of bids. If such action is necessary, all potential bidders who have received or requested a copy of the bid will be notified of the changes to be made in writing and whether the bid opening date will be extended.

Debriefing

Any Vendor may request a debriefing within one (1) week after receiving notification of award, to discuss the Selection Committee's evaluation of its bid proposal. Request for debriefing shall be made in writing to the Purchasing Manager. Debriefing shall not include discussions of any competing bids.

Massachusetts Public Record Law

All bids and related documents submitted in response to this RFP are subject to the Massachusetts Public Records Law, Massachusetts General Law Chapter 66, Section 10 and to M.G.L. Chapter 4, Section 7, Subsection 26, regarding public access to such documents. Statements in the bid response that are inconsistent with those statutes will be disregarded. Any additional questions regarding the Public Records Law should be directed to the Public Records Division at: (617) 727-2832 during regular business hours. You may also access various Public Records Division publications through the Internet at: www.sec.state.ma.us/pre.

Transfers and Subcontracting

The Vendor may not subcontract, in whole or in part, any portion of this contract without the written consent of the University.

Nondiscrimination in Employment and Affirmative Action

The Contractor shall not discriminate against any qualified employee or applicant for employment because of race, color, national origin, ancestry, age, sex, religion, physical or mental handicap, or sexual orientation. The Contractor agrees to comply with all applicable Federal and State statutes, rules and regulations prohibiting discrimination in employment including but not limited to: Title VII of the Civil Rights Act of 1964; the Age Discrimination in Employment Act of 1967; Section 504 of the Rehabilitation Act of 1973; the Americans with Disabilities Act of 1990; and M.G.L. c.151B.

Vendor Not Employee of UML

The Vendor, or his employees or agents performing under the agreement, are not to be deemed to be employees of UML nor to be agents of UML in any manner whatsoever. The Vendor will not hold himself out as, nor claim to be, an officer or employee of UML and will not make any claim, demand, or application to or for right or privilege applicable to an officer or employee of UML, including, but not limited to, workmen's compensation coverage, unemployment insurance benefits, social security benefits, or retirement membership or credit.
Company information and signature required

Company Name: __________________________________________

Company Address: _______________________________________

Tel. #________________________ Fax #_______________________

Are you

() Woman Owned Business
() Minority Owned Business
() Individual/Sole Proprietorship
() Partnership
() Government
() Non-profit Organization
() Corporation
() Disadvantaged Business
() Other (specify) ________________________________

Tax I.D./ FEIN # _____-____-____ or S.S.N.# (if individual) _____-____-____.

Signature of owner or authorized officer*: _______________________________

Please print name: ________________________________

Title: ________________________________

Date submitted: ___/___/___
Certification of Non Collusion

The undersigned certifies under penalties of perjury that this Bid or Proposal has been made and submitted in good faith and without collusion or fraud with any other person. As used in this certification, the word "person" shall mean any natural person, business, partnership, corporation, union, committee, club, or other organization, entity, or group of individuals.

______________________________
Authorized Signature*

______________________________
Printed Name of person signing bid or proposal*)

______________________________
(Name of business)
Business Reference Form

Company Name:___________________________________________________

1. Reference Name:______________________ Contact Person:______________
   Address:_____________________________ Tel Number:________________
   Description and Dates of Services Provided: ___________________________
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

2. Reference Name: _____________________ Contact Person:______________
   Address: _____________________________ Tel Number:________________
   Description and Dates Services Provided: _____________________________
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

3. Reference Name:______________________ Contact Person:______________
   Address:_____________________________ Tel Number:________________
   Description and Dates of Services Provided: ___________________________
   ___________________________________________________________________
   ___________________________________________________________________
   ___________________________________________________________________

Must list all jobs performed in a similar scope in the past 3 years. References will be contacted to confirm Bidder’s abilities, qualifications and performance. The University may deem the Bidder’s response unresponsive if a reference is not obtainable from listed reference after reasonable attempts.
## ATTACHMENT A

**BID FORM – BID # CL16-HT-0037**

**UNIVERSITY OF MASSACHUSETTS LOWELL**

### Pricing:

| Emergency Generator System with accessories | $___________ |
|                                           | $___________ |

**TOTAL PRICE**

| $___________ |

*Total Price must include the delivery and warranty as stated in the bid*

The Bid includes Addenda numbered ________________

In addition to the bid amounts stated above, we agree to abide by all the terms and conditions set out in the Bid.

_______________________________________  __________  
Vendor

_______________________________________________

Address

The awarding Contractor must agree to comply with all applicable Prevailing Wage Rates. By signing this form, the Contractor agrees to pay the applicable Prevailing Wage Rate.
VENDOR BIDDER CHECK LIST

AS A QUALIFIED BIDDER, HAVE YOU INCLUDED:

____ Company information and signature
____ Certificate of non-collusion and tax compliance
____ Business Reference
____ Completed Form for General Bid Attachment A

____ Bids must be delivered No later than 11:00 AM EST., Monday December 14, 2015. Bids received after this date and time will not be accepted.
SECTION 263213 - ENGINE GENERATORS

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.
B. UMass Lowell Campus Electrical Standards; request most up to date standards at time of bid.

1.2 SUMMARY
A. This Section includes packaged engine-generator sets for emergency power supply with the following features:
   1. Diesel engine.
   2. Unit-mounted cooling system.
   3. Unit-mounted control and monitoring.
   4. Load banks.
   5. Outdoor enclosure.
B. Related Sections include the following:
   1. Section 263214 “Installation of Engine Generators” for installation requirements of owner furnished contractor installed engine generators.
   2. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS
A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

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.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [manufacturer]

B. Source quality-control test reports.
2. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
4. Report of exhaust emissions showing compliance with applicable regulations.

C. Field quality-control test reports.

D. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 011000 "Operation and Maintenance Data," include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than [four] hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within [200 miles (321 km)] of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components 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 ASME B15.1.

F. Comply with NFPA 37.

G. Comply with NFPA 70.


I. Comply with UL 2200.

J. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

K. Noise Emission: Comply with [applicable state and local government requirements] for maximum allowable sound level at property line due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.9 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 according to requirements indicated:

1. Notify [Construction Manager] no fewer than [seven] days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without [Construction Manager's] written permission.
B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Altitude: Sea level to [1000 feet (300 m)]

1.10 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: two years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide [24] months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.13 ADDITIONAL SITE VISIT UPON GENERATOR INSTALLATION

A. This generator unit will be purchased by the owner for installation by others. This generator will form part of an NEC article 700 listed life safety power system, and as such requires selective coordination between all life safety circuit breakers. Include cost to return to the site post install and adjust and reprogram the generator controller, and electronic trip output circuit breaker settings based on the outcome of the contractors overcurrent selective coordination study. In additional to a return visit, the generator vendor shall provide the electrical contractor who will be installing the generator, all information required to include the generator system in a power flow study to determine selective coordination settings.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Caterpillar; Engine Div.
   2. Generac Power Systems, Inc.

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 Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:
   1. Power Output Ratings: Nominal ratings as indicated – 200kW.
   3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

D. Generator-Set Performance:
   1. Steady-State Voltage Operational Bandwidth: 3 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 three seconds.
   3. Steady-State Frequency Operational Bandwidth: 0.5 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: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
   6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.

8. Start Time: Comply with NFPA 110, Type 10, system requirements.
   a. Provide permanent magnet excitation for power source to voltage regulator.

9. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel: [Fuel oil, Grade DF-2, Ultra Low Sulfer 15PPM]

B. Rated Engine Speed: 1800 rpm.

C. Maximum Piston Speed for Four-Cycle Engines: 2250 fpm (11.4 m/s).

D. Lubrication System: The following items are mounted on engine or skid:
   1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
   2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
   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.

E. Engine Fuel System:
   2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.

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.

G. Governor: [Electronic].

H. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
   1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
   2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
   3. 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.
4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

   a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
   b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

I. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
   1. Minimum sound attenuation of 25 dB at 500 Hz.
   2. Sound level measured at a distance of 23 feet (7 m) from exhaust discharge after installation is complete shall be 71 dBA or less.
   3. Provide flanged connector for connection of exhaust piping by another project. Intent is for exhaust to discharge 10’ above roofline. Provide details on how to connect additional exhaust piping with generator submittal.

J. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

K. Starting System: 24-V 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 Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
   3. Cranking Cycle: As required by NFPA 110 for system level specified.
   4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
   5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
   6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
   8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
      a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery
ENGINE GENERATORS

2.4 FUEL OIL STORAGE

A. Comply with NFPA 30.

B. Base-Mounted Fuel Oil Tank: Factory installed and piped, complying with UL 142 fuel oil tank. Features include the following:

1. Tank level indicator.
3. Vandal-resistant fill cap.
4. Containment Provisions: Comply with requirements of authorities having jurisdiction. The fuel tank shall be a double-walled, steel construction, and include leak detection provisions, wired to the generator set controller for local and remote alarm indication.
5. The fuel tank shall be constructed of high strength carbon steel.

2.5 CONTROL AND MONITORING

A. 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. When generator set is running, specified system or equipment failures or derangements automatically shut down generator set and initiate alarms. Operation of a remote emergency-stop switch also shuts down generator set.

B. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common wall-mounted control and monitoring panel located in the main Pod 2 electrical room.

C. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level [1] system, and the following:

- 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.
- Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
- Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
- Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
- 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.
- Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
1. AC voltmeter.
2. AC ammeter.
3. AC frequency meter.
4. DC voltmeter (alternator battery charging).
5. Engine-coolant temperature gage.
6. Engine lubricating-oil pressure gage.
7. Running-time meter.
9. Generator-voltage adjusting rheostat.
10. Fuel tank high-level shutdown of fuel supply alarm.
11. Generator overload.

D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

E. Connection to Data Link: A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication is reserved for connections for data-link transmission of indications to remote data terminals.

F. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.

1. Overcrank shutdown.
2. Coolant low-temperature alarm.
3. Control switch not in auto position.
4. Battery-charger malfunction alarm.
5. Battery low-voltage alarm.

G. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

2.6 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.

2. Trip Settings: Selected to coordinate with generator thermal damage curve.
3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
4. Mounting: Adjacent to or integrated with control and monitoring panel.

B. Generator Disconnect Switch: Molded-case type, 100 percent rated.

1. Rating: Matched to generator output rating.
2. Shunt Trip: Connected to trip switch when signaled by generator protector or by other protective devices.
C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

1. Initiates a generator 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 or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

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 or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: Dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.

1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
2.8 LOAD BANK

A. Description: Permanent, outdoor, weatherproof, remote-controlled, forced-air-cooled, [resistive and reactive] unit capable of providing a balanced 3-phase, delta-connected load to generator set at [50] percent rated-system capacity, at [80] percent power factor, lagging. Unit may be composed of separate resistive and reactive load banks controlled by a common control panel. Unit shall be capable of selective control of load in 25 percent steps and with minimum step changes of approximately 5 and 10 percent available.

B. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and steel supports. Elements shall be double insulated and designed for repetitive on-off cycling. Elements shall be mounted in removable aluminized-steel heater cases.

C. Reactive Load Elements: Epoxy-encapsulated reactor coils.

D. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor shall provide uniform cooling airflow through load elements. Airflow and coil operating current shall be such that, at maximum load, with ambient temperature at the upper end of specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.

E. Load Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.

F. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.

G. Load-Bank Enclosures: NEMA 250, Type 3R, complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings shall prevent entry of rain and snow. Openings for airflow shall be screened with 1/2-inch- (13-mm-) square, galvanized-steel mesh. Reactive load bank shall include automatic shutters at air intake and discharge.

H. Protective Devices: Power input circuits to load banks shall be fused, and fuses shall be selected to coordinate with generator circuit breaker. Fuse blocks shall be located in contactor enclosure. Cooling airflow and overtemperature sensors shall automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors shall disconnect load power, control, and heater circuits. Fan motor shall be separately protected by overload and short-circuit devices. Short-circuit devices shall be noninterchangeable fuses with 200,000-A interrupting capacity.

I. Remote-Control Panel: Separate from load bank in NEMA 250, Type 1 enclosure with a control power switch and pilot light, and switches controlling groups of load elements.

J. Control Sequence: Control panel may be preset for adjustable single-step loading of generator during automatic exercising.
2.9 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Description: Prefabricated or preengineered enclosure with the following features:

2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
3. Space Heater: Thermostatically controlled and sized to prevent condensation.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
6. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
7. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
8. Muffler Location: [External to] enclosure.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.

1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.
2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.

D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.10 VIBRATION ISOLATION DEVICES

A. Elastomeric Isolation Pads:

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

   a. Ace Mountings Co., Inc.
   b. California Dynamics Corporation.
   c. Isolation Technology, Inc.
   d. Kinetics Noise Control, Inc.
   e. Mason Industries, Inc.
   f. Vibration Eliminator Co., Inc.
   g. Vibration Isolation.
h. **Vibration Mountings & Controls, Inc.**

2. **Fabrication:** Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.

3. **Size:** Factory or field cut to match requirements of supported equipment.

4. **Pad Material:** Oil and water resistant with elastomeric properties.

5. **Surface Pattern:** [**Smooth**] [**Ribbed**] [**Waffle**] pattern.

6. **Infused nonwoven cotton or synthetic fibers.**

7. **Load-bearing metal plates adhered to pads.**

8. **Sandwich-Core Material:** [**Resilient**] [**and**] [**elastomeric**]
   
   a. **Surface Pattern:** [**Smooth**] [**Ribbed**] [**Waffle**] pattern.
   
   b. **Infused nonwoven cotton or synthetic fibers.**

B. **Restrained Spring Isolators:** Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. **Manufacturers:** Subject to compliance with requirements, [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
   
   a. **Ace Mountings Co., Inc.**
   
   b. **California Dynamics Corporation.**
   
   c. **Isolation Technology, Inc.**
   
   d. **Kinetics Noise Control, Inc.**
   
   e. **Mason Industries, Inc.**
   
   f. **Vibration Eliminator Co., Inc.**
   
   g. **Vibration Isolation.**
   
   h. **Vibration Mountings & Controls, Inc.**

2. **Two-Part Telescoping Housing:** A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with [**adjustable**] snubbers to limit vertical movement.
   
   a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig (3447 kPa).
   
   b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. **Outside Spring Diameter:** Not less than 80 percent of the compressed height of the spring at rated load.

4. **Minimum Additional Travel:** 50 percent of the required deflection at rated load.

5. **Lateral Stiffness:** More than 80 percent of rated vertical stiffness.

6. **Overload Capacity:** Support 200 percent of rated load, fully compressed, without deformation or failure.
2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

2.12 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.


B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:

1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
7. Safety shutdown.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 017900 "Demonstration and Training."
3.3 FUEL

A. Provide all fuel required for testing.

B. Hand over generator system to owner after all acceptance testing is complete with all generator fuel tanks fully filled.

3.4 RETURN VISIT POST INSTALL

A. Generator vendor shall return to site post installation by the electrical contractor. The vendor shall adjust the generator controller and output circuit breakers to selectively coordinate the generator circuit breaker with the rest of the life safety system, as per NEC article 700 requirements. Where the provided circuit breaker cannot be coordinated with the emergency power system, the generator vendor shall work with the electrical contractor to find a suitable circuit breaker, and shall replace the breaker on the unit with no additional labor cost. The circuit breaker, where required, shall be furnished by the project electrical contractor.

END OF SECTION 263213
### Schedule of Panelboard Schedules

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1. Refer to the following E00X Sheets for Panelboard Schedules:
   - 06/10/14 Feasibility Study Set
   - 08/29/14 Schematic Design Set
   - 12/18/14 50% Design Development Set
   - 01/15/15 100% Design Development Set
   - 04/06/15 60% Construction Permit Set
   - 05/07/15 90% Construct. Doc. Set
   - 06/30/15 Tier 1 Phase 1 Permit Set
   - 07/17/15 100% Construct. Doc. Set
**NOTES:**

*CONTINUOUS 1100 VA 125.00% 1375 VA

*MOTOR LOAD 200 VA 112.50% 225 VA

*RECEPTACLE 1000 VA 100.00% 1000 VA

*LIGHTING 852 VA 125.00% 1065 VA

---

**ENCLOSURE:** Type 1

**PHASES:** 3

**VOLTS:** 480/277 Wye

**MAINS TYPE:** 225 A

**MCB RATING:** 225 A

**BUS RATING:** 50 A

**MAINS TYPE:** 100 A

**MCB RATING:** 10 kA

**MCB RATING:** 100 A

**MCB RATING:** 225 A

**MCB RATING:** 14.3 kVA

---

**BREAKERS AS PER SQUARE D ED FRAME. 125A BREAKERS AS PER E3.01 SINGLE LINE.**

---

**TOTAL CONNECTED AMPS:** 9 A 9 A 34 A

**TOTAL NEC LOAD:** 16165 VA

**TOTAL CONNECTED LOAD:** 4300 VA

---

**LPH-FK-1**

**LPH-FK-3**

---

**LPH-FK-1A**

**LPH-FK-1B**

---

**SCHEDULE PLAN**

**DOCUMENT SET**

**E-002**
# Electrical Plan

## Load Classification

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<th>Demand Factor</th>
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## Panel Name:

- **RP-F-1**
- **RP-K-1**

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## Total Connected Load:

- **45 A**
- **44 A**
- **40 A**

## Electrical Plan Specifications

- **Enclosure:** Type 1, Surface
- **Mounting:** Surface
- **Fed From:** ATS1
- **Phases:** 3
- **Volts:** 480/277 Wye
- **A.I.C. Rating:** 35.6 kVA
- **Mains Type:** 225 A
- **MCB Rating:** 35.6 kVA
- **Total NEC Amperes:** 19 A
- **Total NEC Load:** 39123 VA
- **Main:** 225 A
- **Service:** 35.6 kVA
- **Service Entrance:** 480/277 Wye
- **Demand Factor:** Calculated based on connected load
- **Connected Load:** 40 A

## Notes

- **Continuous 1300 VA 125.00% 1625 VA**
- **Non-Continuous 6500 VA 100.00% 6500 VA**
- **Receptacle 360 VA 100.00% 360 VA**

## Sheet Information

- **Checked By:**
- **Drawn By:**
- **Project Number:**
- **University of Massachusetts Lowell
  Arup USA Inc
  4th Floor
  955 Massachusetts Avenue
  Lowell, MA
  01854
  T 617 864 2987 F 617 864 6178
  www.arup.com
- **Sheet Number:** 100% Construction DOCUMENT SET
- **Date:** 7/17/15
- **Drawn on:** 7/17/2015 1:58:04 PM
- **E-003**
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#### A.I.C. Rating:
- Type 1

#### Enclosure:
- Type 1

#### Mounting:
- USS-FK

#### Feds From:
- Phase 4

#### Phases:
- 3

#### Wires:
- 480/277 Wye

#### Volts:
- 277V

#### Total Connected Load:
- 580 VA

#### Total Connected Amps:
- 2 A

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### Panel Name: LP-FK-3

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#### A.I.C. Rating:
- Type 1

#### Enclosure:
- Type 1

#### Mounting:
- USS-FK

#### Feds From:
- Phase 4

#### Phases:
- 3

#### Wires:
- 480/277 Wye

#### Volts:
- 277V

#### Total Connected Load:
- 580 VA

#### Total Connected Amps:
- 2 A

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### Panel Name: RP-K-2

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#### A.I.C. Rating:
- Type 1

#### Enclosure:
- Type 1

#### Mounting:
- USS-FK

#### Feds From:
- Phase 4

#### Phases:
- 3

#### Wires:
- 480/277 Wye

#### Volts:
- 277V

#### Total Connected Load:
- 580 VA

#### Total Connected Amps:
- 2 A

---

### Notes:
- *Motor Load 3700 VA 105.41% 3900 VA*
- *Receptacle 2340 VA 100.00% 2340 VA*
- *Continuous 100 VA 125.00% 125 VA*
- *Motor Load 1160 VA 111.38% 1292 VA*
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**Notes:**

- MOTOR LOAD: 280 VA, 111.5% C.P.
- OEP-FK-3 Panel Name:
- Notes:
- LOAD CLASSIFICATION:
- CONNECTED AMPS: 78 A
- DEMAND FACTOR:
- CALC. NEC LOAD:
- PANEL TOTALS:
- TOTAL CONNECTED AMPS: 20 A
- 45 A
- 20 A

**Enclosure:**
- Type 1

**Mounting:**
- DP-FK1

**Fed From:**
- OEP-FK-1B
- USS-FK

**Volts:**
- 480/277 Wye

**Wires:**
- 3

**Main Breaker:**
- 2000 A

**A.I.C. Rating:**
- 10kA

**Bus Rating:**
- 600 A

**Main Type:**
- MCB

**MCB Rating:**
- 225 A

**Phase:**
- 4

**Total NEC Connectable Amps:**
- 78 A

**Total NEC Connectable Load:**
- 31614 VA

**Total NEC Load:**
- 27709 VA

**Total NEC Amperes:**
- 0 A

**Total NEC Watts:**
- 1900 VA
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<td>MOTOR - POD 1 L1.5 FTR 1 &amp; FTR 2</td>
<td>3490 VA</td>
<td></td>
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</table>

**Notes:**
- TOTAL CONNECTED AMPS: 108 A
- TOTAL CONNECTED LOAD: 27010 VA
- MCB RATING:
  - 69 A
  - 98 A
- BUS RATING:
  - 100 A
- MCb:
  - 69 A
  - 98 A
- A.I.C. RATING:
  - 5.9 kVA
- TOTAL NEC AMPS: 108 A
- TOTAL NEC LOAD: 90148 VA

**Project Details:**
- UNIVERSITY OF MASSACHUSETTS BUILDING AUTHORITY
- UMass Lowell North
- Quad Infrastructure
- Lowell, MA

**Schedule Plan:**
- 7/17/2015 1:58:13 PM

**Electrical Schedule Plan Sheet 6**

**Arup USA Inc**
- Consultants
- 4th Floor
- Cambridge, MA  02139
- (UMBA 13-L2)
## LIGHTING FIXTURE SCHEDULE

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>MANUFACTURER</th>
<th>MODEL NUMBER</th>
<th>DESCRIPTION</th>
<th>WATTAGE</th>
<th>VOLTAGE</th>
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<tbody>
<tr>
<td>1 LIGHTING FIXTURE SCHEDULE</td>
<td>R4</td>
<td>LITHONIA OLVTWM</td>
<td>VAPOR TIGHT LED JAR LIGHT 15 120V (OR APPROVED EQUAL)</td>
<td>REFER TO SHEETS E-706 &amp; E-712 FOR QUANTITIES AND LOCATIONS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>EXIT PHILIPS</td>
<td>CA6RCA1IC CHLORIDE EXIT 5 277V</td>
<td>FACE QTY, ARROWS AND MOUNTING HARDWARE TO SUIT FIELD CONDITIONS</td>
<td></td>
</tr>
<tr>
<td></td>
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<td>W1</td>
<td>PHILIPS LP7 LED DOWNWARD WALL SCONCE 13 120V</td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>S1</td>
<td>PHILIPS OWL440L840-UNV-DIM LED 1X4 STRIPLIGHT 38 277V</td>
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<tr>
<td></td>
<td></td>
<td>R3</td>
<td>PHILIPS PDK (4)523-000004-32 12&quot; COLOR LED LINEAR COVE 6 277V LENGTH AS PER ARCHITECTS PLANS.</td>
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<td>R1</td>
<td>PHILIPS L5RAE1-L5R10835-L5RDW 5&quot; LED DOWNLIGHT 13 277V</td>
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## MOTOR EQUIPMENT SCHEDULE

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<thead>
<tr>
<th>TAG</th>
<th>HW</th>
<th>VOLT</th>
<th>PH</th>
<th>HP</th>
<th>KVA</th>
<th>FLA</th>
<th>PANEL</th>
<th>BRANCH WIRING (COPPER THHN)</th>
<th>STARTER/CONNECT TYPE</th>
<th>NOTES</th>
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<tr>
<td>1</td>
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<td>208</td>
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<td>0.1</td>
<td>0.5</td>
<td>SP-P3</td>
<td>45,47</td>
<td>1 #12 #12 3/4&quot; DISCONNECT</td>
<td>1 20 EC</td>
<td>PROVIDE 3/4 INCH CONDUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT FOR CONTROLS. PROVIDE #12 PULL WIRE</td>
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<td>0.5</td>
<td>SP-P3</td>
<td>45,47</td>
<td>1 #12 #12 3/4&quot; DISCONNECT</td>
<td>1 20 EC</td>
<td>PROVIDE 3/4 INCH CONDUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT FOR CONTROLS. PROVIDE #12 PULL WIRE</td>
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<td>0.5</td>
<td>SP-P3</td>
<td>24,26</td>
<td>1 #12 #12 3/4&quot; DISCONNECT</td>
<td>1 20 EC</td>
<td>PROVIDE 3/4 INCH CONDUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT FOR CONTROLS. PROVIDE #12 PULL WIRE</td>
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<tr>
<td>4</td>
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<td>0.5</td>
<td>SP-P3</td>
<td>24,26</td>
<td>1 #12 #12 3/4&quot; DISCONNECT</td>
<td>1 20 EC</td>
<td>PROVIDE 3/4 INCH CONDUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT FOR CONTROLS. PROVIDE #12 PULL WIRE</td>
</tr>
<tr>
<td>5</td>
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<td>208</td>
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<td>1.4</td>
<td>6.5</td>
<td>OEP-FK-1B</td>
<td>25,27</td>
<td>1 #12 #12 3/4&quot; DISCONNECT</td>
<td>1 20 EC</td>
<td>PROVIDE 3/4 INCH CONDUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT FOR CONTROLS. PROVIDE #12 PULL WIRE</td>
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<td>OEP-FK-3</td>
<td>11,13</td>
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<td>1 20 EC</td>
<td>PROVIDE 3/4 INCH CONDUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT FOR CONTROLS. PROVIDE #12 PULL WIRE</td>
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<td>OEP-FK-2</td>
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<td>1 #12 #12 3/4&quot; DISCONNECT</td>
<td>1 20 EC</td>
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<td>8</td>
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<td>OP-SP-3</td>
<td>5,7</td>
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<td>9</td>
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<td>OP-SP-1</td>
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<td>1 20 EC</td>
<td>PROVIDE 3/4 INCH CONDUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT FOR CONTROLS. PROVIDE #12 PULL WIRE</td>
</tr>
<tr>
<td>10</td>
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<td>OP-SP-1</td>
<td>26,28</td>
<td>1 #12 #12 3/4&quot; DISCONNECT</td>
<td>1 20 EC</td>
<td>PROVIDE 3/4 INCH CONDUIT BETWEEN INDOOR UNIT AND OUTDOOR UNIT FOR CONTROLS. PROVIDE #12 PULL WIRE</td>
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<tr>
<td>11</td>
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<td>0.5</td>
<td>RP-F-3</td>
<td>3</td>
<td>1 #12 #12 3/4&quot; DISCONNECT/STARTER</td>
<td>1 20 MC</td>
<td>STARTER FURNISHED BY MC (ECM MOTOR).</td>
</tr>
<tr>
<td>12</td>
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<td>1 #12 #12 3/4&quot; DISCONNECT/STARTER</td>
<td>1 20 MC</td>
<td>STARTER FURNISHED BY MC (ECM MOTOR).</td>
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<td>31</td>
<td>1 #12 #12 3/4&quot; DISCONNECT/STARTER</td>
<td>1 20 MC</td>
<td>STARTER FURNISHED BY MC (ECM MOTOR).</td>
</tr>
</tbody>
</table>

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**UMass Lowell North Quadrangle Infrastructure Renewal**

**UMass Lowell North Quadrangle Infrastructure Renewal**

**UMass Lowell North Quadrangle Infrastructure Renewal**

**UMass Lowell North Quadrangle Infrastructure Renewal**

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**100% CONSTRUCTION DOCUMENT SET**

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**E-008**
1. GENERATOR TO BE OWNER FURNISHED, CONTRACTOR INSTALLED.

7. ALL WIRING SHALL BE TYPE THWN RATED 75°C MIN., 600 VOLT, WET OR DRY.

5. AS A MINIMUM, DISCONNECT SWITCHES SHALL BE RATED AT FRAME MAGNETIC TRIPS.

2. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE MEP/SYSD DRAWINGS AND SPECIFICATIONS.

11. SETTINGS AS PER CONTRACTORS SHORT COORDINATION STUDY SYSTEM TOPOLOGY ONLY.

SHALL MEET REQUIREMENTS OF MASS STATE ELECTRIC CODE.

IN ALL PANELBOARDS, PROVIDE SPARE CB'S AND SPACE ONLY INCASE OF BREAKER FAILURE.

BASIS OF DESIGN: SUBFEED BREAKERS AS PER SQUARE D "MINI BREAK" OR APPROVED ON BREAKER LCD SCREEN.

FUNCTION WITH CURRENT PER PHASE DISPLAYED.
1. SEE E4.02 FOR MORE INFORMATION ON SITE ELECTRICAL POWER PROVISION FOR FIRE ALARM.
2. 120V POWER IN CEILING MOUNTED JUNCTION BOX FOR POWER FOR FSD LOCATED WITHIN FLOOR SLAB. INSTALLED POWER FOR FSD. INSTALLED BY OTHERS, WIRED BY EC.
3. CONDUITS BELOW SLAB. TURN TO ENTER PRIMARY SWITCH MAIN GROUNDBAR. SEE E3.01 FOR MORE INFORMATION.
4. POWER FOR DDC PANEL. FINAL CONNECTION OF DDC PANEL DISCONNECT SWITHC AND INSTALL ASSOCIATED WIRING.
5. L5-30 OUTLET MOUNTED IN OVERHEAD CABLE TRAY.
6. L6-30 OUTLET MOUNTED IN OVERHEAD CABLE TRAY.
7. PROVIDE 4" CONCRETE HOUSEKEEPING PAD.
8. HEAT TRACE SYSTEM. FINAL CONNECTION TO HEAT TRACING CONTROL PANEL BY EC, CONNECTION OF HEAT TRACING CABLE TO CONTROL PANEL BY HEAT TRACING INSTALLER.
9. NEW PLATFORM LIFT. PROVIDE FUSE SIZE AS PER STRUCTURAL DRAWINGS FOR FLOOR TRENCHING FROM BELOW. COORDINATE EXACT CONDUIT STUB UP CLEARANCE. MAIN 4160V FEEDERS TO ENTER UNIT BE LOCATED BETWEEN BEAMS TO ENSURE ADEQUATE EXISTING STRUCTURAL BEAMS. TRANSFORMER SECTION TO LIFT BY EC.
10. PRIMARY AND SECONDARY TRANSFORMER DISCONNECTS.
11. WATER COOLER. WIRED BY EC, INSTALLED BY OTHERS.
12. 190.76sf
13. 254.97sf
14. 459.2sf
15. 465.73sf
FOR REQUIREMENTS REFER TO ELECTRICAL RISER DIAGRAM

NOTES:
1. PROVIDE A RELAY MODULES TO OPERATE FAN STARTER.
2. LOCATE ACTIVATION RELAYS WITHIN 3 FT OF DEVICE BEING CONTROLLED IN ACCORDANCE WITH NFPA 72.
3. WIRE THERMOSTAT SO BOTH THERMOSTAT AND FIRE ALARM CAN START FAN.
4. EM LIGHTING CIRCUITS REQUIRE UL924 BYPASS RELAY TO ACTIVATE ON LOSS OF MAINS POWER.

3M FIRE BARRIER (MINERAL WOOL OR FIRE RATED CONCRETE FLOOR SLAB DAMMING MATERIAL CERAMIC FIBER)
UMass Lowell North Quad Infrastructure Renewal
Lowell, MA
University of Massachusetts Building Authority
University of Massachusetts Lowell

ARCHITECT
CONSULTANT
STAMP
MARK
DATE

PROJECT NUMBER: M-712
DRAWN BY:
CHECKED BY:

SHEET TITLE

100% CONSTRUCTION DOCUMENT SET

www.arup.com
955 Massachusetts Avenue
4th Floor
Cambridge, MA 02139
T 617 864 2987 F 617 864 6178
Arup USA Inc

7/20/2015 3:02:43 PM
M-712

MECHANICAL POD 2
ENLARGED FLOOR PLANS - ROOF

MECHANICAL - ROOF ENLARGED PLAN (POD 2)
1 GENERATOR FLue ELEVATION
(Part of Work of Section 260002 – ELECTRICAL, Trade Bid Required)

SECTION 263214 – INSTALLATION OF ENGINE GENERATORS

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.

B. UMass Lowell Campus Electrical Standards; request most up to date standards at time of bid.

1.2 SUMMARY

A. This Section includes installation of packaged engine-generator sets for [emergency] power supply with the following features:

1. [ DIESEL ] engine.
2. [ UNIT-MOUNTED ] cooling system.
3. [ UNIT-MOUNTED ] control and monitoring.
4. Load banks.
5. Outdoor enclosure.

B. Related Sections include the following:

1. Section 263213 “Engine Generators” for owner furnished contractor installed generator equipment requirements.
2. Section 263600 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

B. LP: Liquid petroleum.
1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 011000 "Operation and Maintenance Data," include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than [four] hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within [200 miles (321 km)] of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Source Limitations: Obtain packaged generator sets and auxiliary components 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 ASME B15.1.

F. Comply with NFPA 37.

G. Comply with NFPA 70.


I. Comply with UL 2200.

1.6 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 according to requirements indicated:
1. Notify [Construction Manager] no fewer than [seven] days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without [Construction Manager’s] written permission.

B. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
   1. Altitude: Sea level to [1000 feet (300 m)]

1.7 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.8 WARRANTY

A. Special Warranty: Generator is pre purchased and comes with a 2 year warranty. All work carried out under this section shall be warrantied as per the general conditions of the project.

1.9 MAINTENANCE SERVICE

A. Generator unit comes with 24 months maintenance contract. Engage the maintenance contractor at the end of installation to carry out all required maintenance.

PART 2 - PRODUCTS

2.1 Generator shall be owner furnished, contractor installed. Unit shall be 200kW, diesel fueled with level II acoustic weatherproof enclosure. Coordinate all information with the construction manager.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Formally receive pre purchased generator. Engage the generator manufacturer to perform pre start up checks on the unit prior to accepting for installation. Once accepted, store and handle unit as detailed in part 3 of this specification.

B. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.
3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in [Section 033000 "Cast-in-Place Concrete." ] [Section 033053 "Miscellaneous Cast-in-Place Concrete." ]
   1. Comply with requirements for vibration isolation devices specified in this section.

D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet. Flexible connectors and steel piping materials and installation requirements are specified in Section 232116 Hydronic Piping Specialties.
   1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints. Flexible connectors and piping materials and installation requirements are specified in Section 232116 Hydronic Piping Specialties.

E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance. Coordinate extended generator flue with flue installer. Generator flue shall discharge 10’ above roof level.

C. Connect engine exhaust pipe to engine with flexible connector.

D. Connect fuel piping to engines with a gate valve and union and flexible connector.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems." Generator shall be a separately derived power source.
F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Section 230553 "Identification for HVAC Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. 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.

B. 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 installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.

2. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.

   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.

   c. Verify acceptance of charge for each element of the battery after discharge.

   d. Verify that measurements are within manufacturer's specifications.

3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.

5. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg (120 kPa). Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.


D. Coordinate tests with tests for transfer switches and run them concurrently.
E. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

I. Remove and replace malfunctioning units and [retest] as specified above.

J. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

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

L. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 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 terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

M. Output circuit breaker settings: Life safety power systems are to selectively coordinate to 0.01s. Select and set generator main circuit breaker based on outcome from “26057 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY”. Engage vendor for information on circuit breaker to include in overcurrent protective study, and then follow up with vendor to come to site and reset any circuit breaker settings, or generator controller settings requiring adjustment prior to completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Section 017900 "Demonstration and Training."
3.7 FUEL

A. Provide all fuel required for testing.

B. Hand over generator system to owner after all acceptance testing is complete with all generator fuel tanks fully filled.

END OF SECTION 263213
SECTION 263600 - TRANSFER SWITCHES

(Part of Work of Section 260002 – ELECTRICAL, Trade Bid Required)

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.

B. UMass Lowell Campus Electrical Standards; request most up to date standards at time of bid.

1.2 SUMMARY

A. Section includes transfer switches rated 600 V and less, including the following:
   1. Automatic transfer switches.
   2. Remote annunciation systems.

1.3 ACTION 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.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [manufacturer].

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," 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.
1.6 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 eight 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] and [remote annunciators] through one source from a single manufacturer.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NEMA ICS 1.

F. Comply with NFPA 70.

G. Comply with NFPA 110.

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

1.7 FIELD 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 [Construction Manager] no fewer than [seven] days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without [Construction Manager's] written permission.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."
PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Contactor Transfer Switches:

1. Manufacturers: Subject to compliance with requirements, [provide products by the following]

   a. AC Data Systems, Inc.
   b. Caterpillar; Engine Div.
   c. Emerson; ASCO Power Technologies, LP.
   d. Generac Power Systems, Inc.
   e. GE Zenith Controls.
   f. Kohler Power Systems; Generator Division.
   g. Onan/Cummins Power Generation; Industrial Business Group.
   h. Russelectric, Inc.
   i. Spectrum Detroit Diesel.

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 percent 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.

C. Solid-State Controls: Repetitive accuracy of all settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg 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 four-pole switches are indicated, provide [neutral pole switched simultaneously with phase poles].
H. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

I. 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 specified in Section 260553 "Identification for Electrical Systems."
   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.

J. Enclosures: General-purpose NEMA 250, Type [I] complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 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.


E. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval is adjustable from 1 to 30 seconds.

F. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

G. 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 to 100 percent of nominal, and dropout voltage is adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
   2. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.

4. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes 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.

   a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."

8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

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 one isolated and normally open; rated 10 A at 32-V dc minimum.

11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. 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 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings are for 7-day exercise cycle, 20-minute running period, and 5-minute 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.

2.4 REMOTE ANNUNCIATOR SYSTEM

A. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches. Annunciation shall include the following:

1. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
2. Switch position.
3. Switch in test mode.
4. Failure of communication link.

B. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
   1. Indicating Lights: Grouped for each transfer switch monitored.
   2. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
   3. Mounting: Flush, modular, steel cabinet, unless otherwise indicated.
   4. Lamp Test: Push-to-test or lamp-test switch on front panel.

2.5 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

A. Functional Description: Include the following functions for indicated transfer switches:
   1. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
   2. Indication of switch position.
   3. Indication of switch in test mode.
   4. Indication of failure of digital communication link.
   5. Key-switch or user-code access to control functions of panel.
   6. Control of switch-test initiation.
   7. Control of time-delay bypass for transfer to normal source.

B. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically reverts to stand-alone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.

2.6 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.

B. Identify components according to Section 260553 "Identification for Electrical Systems."

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

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. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:

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


   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 three 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. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.
   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.
5. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
   
a. Verify grounding connections and locations and ratings of sensors.

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

C. 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.

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

E. Prepare test and inspection reports.

F. 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. Refer to Section 017900 "Demonstration and Training."

B. Coordinate this training with that for generator equipment.