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BuildingName
The Description of the Project
P00000000 0000

SPECIFICATION DIVISION 26

NUMBER SECTION DESCRIPTION

DIVISION 26 ELECTRICAL
SECTION 263000 - ENGINE-GENERATOR SYSTEM

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DIVISION 26 ELECTRICAL
SECTION 263000 - ENGINE-GENERATOR SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 01 Specification Sections, and other applicable Specification Sections, in particular the Related Sections listed below, apply to this Section.

B. Related Sections:

1. Section 017823 - Operation and Maintenance Manual
2. Section 019100/019110 - Commissioning
3. Section 213113 - Fire Pumps
4. Section 231123 - Facility Natural Gas Piping
5. Section 235100 - Breechings, Chimneys and Stacks
6. Section 260513 - Medium, Low & Control Voltage Cables
7. Section 260526 - Grounding and Bonding for Electrical
8. Section 260533 - Electrical Materials and Methods
9. Section 260800 - Electrical Acceptance Tests

1.2 SUMMARY

A. Section Includes:

1. Packaged natural gas fueled engine-generator sets for emergency and/or standby power supply, rated as defined below and as shown on the Drawings.
2. Open transition, closed transition and/or soft-loading automatic transfer switches (ATSs) with full maintenance bypasses, rated as defined below and as shown on the Drawings.
3. Accessories as defined below.

B. Work Not Included:

1. Natural gas piping from the utility gas regulator including a gas line isolation valve at the engine-generator, except the gas strainer, secondary regulator, gas pressure gauge and solenoid valve shall be provided with the engine-generator.
2. Exhaust system from the engine silencer to its discharge point, except the rain cap shall be provided with the engine-generator.

1.3 SUBMITTALS

A. Manufacturer name and model number of major components.

B. Shop Drawings including overall plan and elevation of major components with dimensions. Indicate the required installation and maintenance access clearances, conduit entry points, and cable termination point details.

C. Details for weatherproof enclosure including maintenance access details and dimensions, fluid check and drain details and acoustic performance details.

D. Battery and charger details, model numbers, and interconnection details.

E. Remote annunciator panels, points monitored, wiring requirements, and spare contacts available to other monitoring systems.

F. Size, weight, and movement restrictions of shipping sections.

G. Diagrams and data noting normal load, sustainable fault current during faults downstream, and emergency ratings of the system.

1. Generator impedance data.
2. Generator thermal damage curve.
3. Generator breaker time-current characteristic curves.

H. Computer simulations showing the anticipated voltage and frequency dips during the specified step loading sequence.

I. Fuel supply flow requirements including volumetric flow rate and pressure to achieve 100 percent full load in the specified time.

J. Projected sound level of system measured at 7 meters (23 feet) in front of the radiator. Include the load bank's sound contribution if a load bank is adjacent to the generator.

K. Exhaust gas temperatures at full load.

L. Complete wiring diagrams specific to this project, including control wiring between the engine-generator, automatic transfer switches, load bank, remote start and stop switches, remote annunciators, ATS position indicating lights, and outputs to the Building Automation System.

M. Automatic Transfer Switches

1. Manufacturer and model
2. Overall physical sizes, weights, environmental constraints.
3. Voltage ratings, ampere ratings, number of poles.
4. Full power schematic including maintenance bypass assembly.
5. Affirmation that ATS is UL listed for this application.

N. Certified reports of source quality control and factory tests prior to engine-generator delivery.

1. Certification of engine compliance to the current Environmental Protection Agency (EPA) emissions standards.
2. Certifications of compliance with NFPA 110 for a Level 1 system, and with UL 2200.
3. Certification of compliance with transient and voltage dip responses and steady state voltage and frequency stability.
4. Test reports, signed and dated, for all factory and prototype tests.

O. Installation, Operation and Maintenance (O&M) manuals per Related Sections.

P. Commissioning reports and documentation per Related Sections.

Q. Warranty Documentation.

1.4 DELIVERY, STORAGE AND HANDLING

A. Protect the engine-generator, automatic transfer switches, and accessories from the weather, moisture condensation, dirt, and debris at all times. Do not stage equipment on the ground.

B. Deliver engine-generator, automatic transfer switches, and accessories adequately packaged for lifting, skidding, or rolling into final position, according to manufacturer's instructions.

1.5 QUALITY ASSURANCE

A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

B. Reference Standards: Products in this section shall be built, tested, factory certified and installed in compliance with the specified quality assurance standards; latest editions, unless noted otherwise.

1. EPA emissions standards for stationary internal combustion engines.
2. IEEE C2, "National Electrical Safety Code".
3. IEEE Standard 446, "IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications".
4. NEMA Standard ICS 10, "AC Automatic Transfer Switches".
5. NEMA Standard MG 1, “Motors and Generators”.
6. NFPA 70, "National Electrical Code".
7. NFPA 110, "Emergency and Standby Power Systems".
8. UL 1008, "Standard for Automatic Transfer Switches".
9. UL 2200, "Standard for Stationary Engine Generator Assemblies".

C. Perform manufacturer's standard quality assurance testing on the engine-generator system prior to shipping.

1.6 WARRANTY

A. Provide a complete parts and labor warranty for a minimum of one year from the date of Substantial Completion.

1. Return a call for service within 24 hours, and provide a repair person on site within 48 hours after the call.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Engine-Generator Manufacturers: Subject to compliance with all requirements, provide generators from one of the following manufacturers:

1. Caterpillar.
2. Cummins Power Generation.
3. Generac Industrial Power.
4. Kohler Co.

B. Open and Closed Transition Automatic Transfer Switch Manufacturers: Subject to compliance with all requirements, provide ATSs from one of the following manufacturers:

1. ASCO.
2. Cummins.
3. Eaton.
4. GE Zenith.
5. Kohler.

C. Soft Loading Automatic Transfer Switch Manufacturers: Subject to compliance with all requirements, provide ATSs from one of the following manufacturers:

1. ASCO.
2. Eaton.
3. Kohler.

D. Load Bank Manufacturers: Subject to compliance with all requirements, provide load banks from one of the following manufacturers:

1. Avtron.
2. Sephco.
3. Simplex.

2.2 ENGINE-GENERATOR ASSEMBLY

A. The system including all components shall be NFPA 110 Level 1 compliant, UL 2200 labeled, and rated for operation in a Seismic Category B area at an elevation up to 1,000 feet above sea level.

B. The system shall be rated to provide power in four steps while complying with the specified transient and steady state voltage and frequency requirements:

1. **20** kW emergency power in 10 seconds to life safety loads and high rise elevators.
2. **150** kW required standby power in 30 seconds to mechanical system motor loads.
3. **100** kW required standby power in 45 seconds to fire pump.
4. **100** kW optional standby power in 60 seconds to laboratory equipment including computer servers and freezers.

C. Configure the engine-generator for outdoor installation in an enclosure. Outdoor temperatures range from minus 22 degrees F to 104 degrees F (minus 30 degrees to 40 degrees C), with condensing conditions, rain, snow, or ice all being possible.

D. Configure the engine-generator for indoor installation in a room supplied with combustion and ventilation air directly from the outside. Outdoor air temperatures range from minus 22 degrees F to 104 degrees F (minus 30 degrees to 40 degrees C) and humidity may be condensing.

E. Mount the engine-generator with vibration isolators on a welded steel base, to permit suitable mounting on any level surface.

F. Provide engraved metal or laminated plastic nameplates indicating ratings of equipment and Manufacturer's shop order number for the equipment. Laminated plastic nameplates shall consist of black letters at least 1/4" high on a white background. The nameplates shall be affixed with machine screws.

2.3 ENGINE

A. Provide a natural gas fueled, liquid cooled, naturally or blower aspirated engine of 4-cycle design, sized as required to meet the specified generator kW output continuous rating.

B. The engine shall be factory certified as compliant with the current EPA emissions standards. When the engine is not factory certified as compliant with EPA emissions standards, provide an EPA compliant capable engine. Provide the services of an independent testing agency to perform the first field certification.

C. Provide controls to allow emergency load pickup in 10 seconds or less, with recovery time of less than 3.5 seconds, a voltage dip of less than 39.5%, and a frequency dip of less than 1.5 Hz.

D. The engine-generator shall produce full rated output at a gas pressure of 10"-20" inches of water column.

E. Provide a unit mounted radiator, fan, engine-driven coolant pump, and closed coolant recovery system with the following.

1. Coolant solution of 50 percent ethylene-glycol antifreeze and 50 percent water.
2. A sight glass in which the coolant level can easily be observed.
3. A reclamation bottle to contain coolant overflow.
4. Coolant fill and oil fill drain points that are easily accessible for maintenance without the use of a pump and hoses.
5. A radiator designed to allow safe full load operation in minus 22 degrees to 104 degree F ambient temperature conditions.
6. A duct flange on the radiator outlet.
7. A fan guard for personnel safety.

F. Provide an intake air filter with replaceable element.

1. Provide an electronic isochronous governor with speed sensing to maintain generator output frequency within 0.5 percent from no load to full load during steady state conditions, and within 5 percent during a 50 percent step load increase or decrease.

G. When required to achieve full rated output at 104 degrees F ambient air temperature, provide an aftercooler to cool the combustion air. The aftercooler shall be equipped with the same accessories as the radiator.

H. Provide a starter battery system to serve the engine-generator and automatic transfer switches, including:

1. Lead acid storage batteries, battery rack, and all cables and connections. Size the battery for the range of ambient conditions and to meet the power requirements of the engine-generator and automatic transfer switches after eight cyclic attempts to start the engine.

2. A remotely mounted battery charger with a solid state voltage regulator in a separate enclosure suitable for wall mounting near the batteries.
3. Remote 2-wire starting utilizing a solenoid shift electric starter.

I. Provide an engine-driven positive displacement lube oil pump to supply full pressure lubrication. Provide a replaceable, easily accessible oil filter with internal bypass.

J. Provide an engine fuel system designed for operation on natural gas having a BTU content of 1000 BTU per cubic foot. Include a gas strainer, secondary gas regulator, gas pressure gauge downstream of the regulator, gas solenoid valve, flexible gas line, and all necessary piping, installed at the point of manufacturing, and terminating at a single pipe opening external to the mounting base.

K. Provide sensing elements for oil pressure, coolant temperature, coolant level, overcrank, and overspeed. Connect these sensors to the control panel using a wiring harness with wire numbering at each end of the harness for easy identification. Provide each connection with a molded rubber boot to protect the connection from corrosion. Provide all wiring in flexible conduit with wiring and conduit rated for the application.

L. Provide an engine mounted, thermostatically controlled, 208 Volt or 120 Volt, single phase, coolant jacket heater to aid in quick starting.

M. Provide a silencer rated for a minimum sound attenuation of 35 dB when measured 7 meters from its discharge opening. Mount the silencer and connect to the exhaust stack using a flexible, seamless, stainless steel exhaust connection. Provide a hinged, flapper style rain cap. A stack termination that deflects exhaust horizontally, including an inverted cone style cap is not acceptable. Properly size all components to assure operation without excessive backpressure.

N. Silencer shall be selected and sized by engine manufacturer and designed with an exhaust piping system that will not exceed manufacturer's engine backflow pressures.

O. Provide a catalytic converter when necessary to meet EPA emissions standards. The catalytic converter may be separate from or integral to the silencer. It shall include a hatch or port for changing of the catalyst.

P. Provide a manual blow-down ball valve no more than 78 inches above the floor in a pipe tapped into the low point of the exhaust system. Pipe the discharge to a bucket on the floor.

2.4 GENERATOR

A. Provide a 4-pole, 3-phase, 4-wire, ungrounded wye, brushless 60 Hz alternator with a 2/3 pitch and fully linked amortisseur windings, rated as indicated on the Drawings. Mount and directly connect the generator to the engine shaft to ensure permanent alignment. Extend all phase and neutral leads into a connection panel.

B. Generator shall include an integral brushless permanent magnet exciter.

C. Generator and exciter shall have Class H insulation rated for a temperature rise of 105 degrees C over a 40 degrees C ambient.

D. Provide a solid-state voltage regulator, separate from the exciter, to control output voltage within 1.0 percent from no load to full load during steady state conditions, and within 20 percent during a 50 percent step load increase or decrease. Upon a 50 percent step load increase, the voltage shall recover to steady state within 3.0 seconds.

1. If a heavy load dips the output frequency, the voltage regulator shall have a voltage droop of 4 volts/hertz to maximize motor starting capability. The frequency at which the droop operation begins shall be adjustable, allowing the generator to be properly matched to the load characteristics and ensuring optimum system performance.
2. Provide a limiting circuit in the voltage regulator to prevent output voltage surges in excess of 110 percent of rated voltage during generator set operation.
3. Provide capability of the voltage regulator to shut down on a loss of the sensing signal, to prevent an overvoltage condition from occurring. A voltage regulator that can go into a full field condition is unacceptable.
4. Provide LED lights on the voltage regulator to indicate proper sensing and operation.
5. Provide a minimum of plus or minus 10 percent voltage adjustment from the rated value.
6. At no load the generator's harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for any single harmonic. The Telephone Influence Factor as determined according to NEMA MG 1 shall not exceed 50 percent.
7. For a 3 phase bolted fault at the output terminals, the generator shall produce a minimum of 250 percent of rated full load current for not less than 10 seconds, with no damage to the engine-generator.

E. Provide a connection panel that is an integral part of the generator to allow the Contractor a convenient location to make electrical output connections. Panel shall be NEMA 1. The panel shall include phase and isolated neutral connection bars suitable to accept Owner's 2 hole compression lugs. Provide a NEMA standard 2 hole compression lug sized for No 4/0 AWG cable for bonding of the engine-generator.

F. Provide UL listed, 100 percent rated, generator main circuit breakers with adjustable long time, short time, and instantaneous trip settings, rated as shown on the drawings. A system utilizing a manual reset generator field circuit breaker with current transformer is not acceptable. Locate the circuit breakers in the generator connection panel. Provide barriers between emergency and standby power circuit breakers.

G. Provide a DC-operated shunt trip coil on each generator main circuit breaker, with coils rated at the engine starter battery system voltage. Mounting level shall be accessible from adjacent grade.

2.5 CONTROLS

A. Provide an NFPA 110 Level 1 compliant engine-generator control panel in a NEMA 1 enclosure, shock mounted to the engine-generator set by the manufacturer. The top of the panel shall be no more than 78 inches above the finished floor.

B. Provide a fused low voltage control circuit to power the controls.

C. Provide the following analog or digital indicators and controls as required by NFPA 110 for a Level 1 system. The AC voltmeter, AC ammeter and frequency meter shall be three separate indicators, not part of a scrollable digital display.

1. AC voltmeter.
2. AC ammeter.
3. Frequency meter.
4. Voltmeter and ammeter phase-selector switches.
5. DC voltmeter (battery charging voltage).
6. Generator voltage adjustment.
7. Engine cool-down timer.
8. Non-resettable engine run-time meter.
9. Engine coolant temperature gauge.
10. Engine lubricating-oil pressure gauge.
11. Complete engine start-stop control, which starts the engine upon a contact closure and stops the engine upon a contact opening.
12. Cyclic cranking limiter to open the starting circuit after eight attempts if the engine has not started within that time.
13. 3-position RUN/OFF/AUTOMATIC selector switch. The engine-generator annunciator shall monitor this switch and provide a “Generator Trouble” alarm when the switch is not in AUTOMATIC.
14. "Generator Running" and "Generator Trouble" output contacts for connection to the Building Automation System DDC panel.

D. Provide a solid state annunciator complying with NFPA 110 on the control panel, complete with individual alarm lights, a common audible alarm with reset switch, and one common “Generator Trouble” output contact indicating the following engine and generator conditions:

1. Engine-generator system providing power.
2. Overcrank shutdown.
3. High coolant temperature shutdown.
4. Low lube oil pressure shutdown.
5. Overspeed shutdown.
6. Loss of coolant shutdown.
7. Overvoltage shutdown.
8. Low coolant temperature alarm.
9. High coolant temperature pre-alarm.
10. Low coolant level pre-alarm.
11. High battery voltage alarm.
12. Low battery voltage alarm.
13. Battery charger failure.
14. Control switch not in Automatic alarm.
15. Lamp test.
16. Per NEC 700.3(F), permanent generator is disconnected from the emergency system.

E. Provide a remote manual stop station with a red mushroom head pushbutton and a clear plastic hinged cover in accordance with NFPA 110. The stop station shall be waterproof and suitable for wall mounting outdoors. Locate stop station remotely from the engine generator control panel and the engine generator enclosure where directed by the Owner.

2.6 ENGINE-GENERATOR ACCESSORIES

A. Provide a weather-tight protective enclosure for the engine-generator set as follows:

1. Provide a heavy gauge steel enclosure constructed with corner posts. Provide a solid steel floor. Coat the enclosure with electrostatic applied zinc and finish with baked enamel paint on all interior and exterior surfaces.
2. Provide a sound attenuating type enclosure including louvers, with sound insulated walls, roof, floor, and doors, which achieves a maximum of 70 dBA at 7 meters.
3. Provide bird screens and filters arranged to permit air circulation while excluding exterior dust, birds, rodents, and the insertion of foreign objects.
4. Locate the silencer and catalytic converter inside the enclosure.
5. Provide large, easily opened doors on the enclosure to allow access to the engine, generator, radiator and aftercooler caps, all normally accessed maintenance points including oil and coolant fill, drain and filter points, and the control panel. Provide each door with stainless steel lockable hardware with identical keys. Padlocks are not acceptable.
6. Construct the enclosure of sufficient structural integrity to resist deformation and denting by people climbing on it and rugged enough to be vandal resistant. Comply with the Michigan Building Code requirements for wind loads.
7. Provide the enclosure with 120 Volt dust and moisture resistant, low temperature, interior fluorescent lighting, a light switch, and two 120 Volt GFCI duplex receptacles.

B. Provide a 208Y/120 Volt, 60 amp minimum, 3 phase, main lugs only load center panel with circuit breakers to feed the battery charger, coolant jacket heater, motorized ventilation dampers, lights, and receptacles. Mount the load center panel where shown on the Drawings.

C. Provide a remote annunciator panel to monitor alarm and trouble conditions at the engine-generator, batteries, and battery charger. The annunciator shall be in a NEMA 1 enclosure suitable for flush or surface mounting on a wall.

1. Provide an "Engine-generator providing power" alarm light in the annunciator.
2. Provide the same alarm lights contained on the engine-generator control panel annunciator.

2.7 AUTOMATIC TRANSFER SWITCHES

A. Provide open-transition, closed-transition, and/or soft-loading automatic transfer switches (ATSs) with full maintenance manual bypass isolation, UL 1008 listed, rated and with the number of poles indicated on the Drawings.

1. Open-transition ATSs shall perform an open transition (break-before-make) transfer from the normal to the emergency source and a break-before-make retransfer back to the normal source. A sync-check relay shall normally delay retransfer (when both sources are available) until both sources are close to being in synchronization.
    a. Open-transition ATSs only shall provide a retransfer pre-signal to elevators operating on emergency power.
    b. The pre-signal shall be a dry contact closure at an adjustable time of 1 to 10 seconds before retransfer.
2. Closed-transition ATSs shall perform a closed-transition (make-before-break) transfer from the normal to the emergency source and a closed transition retransfer back to the normal source, thus eliminating a momentary interruption of power to the loads. A sync-check relay shall normally delay transfer and retransfer (when both sources are available) until both sources are close to being in synchronization.
3. Soft-loading ATSs shall provide the same modes of operation as the closed-transition ATSs and include paralleling and protective control equipment to permit the following additional modes:
    a. Soft Load Transfer Mode: Allows the ATS load to be completely isolated from the utility using a programmed soft load transfer / retransfer sequence to or from the engine-generator.
    b. Maintained Parallel Base Load: Establishes and maintains a safe parallel connection of the engine-generator with the normal source until a local or remote signal terminates this condition. The engine-generator shall operate at the base load level set by the Owner on the control panel.
    c. In the event either source connected to the load becomes unacceptable while in any operating mode, the soft load ATS shall automatically isolate the emergency and normal sources and revert to operation as an open transition ATS.

B. ATSs shall be rated to close on and withstand, and UL 1008 tested and labeled with a 1.5 or 3 cycle rating of [insert] amps minimum RMS symmetrical short circuit current when used with any upstream circuit breakers. ATSs not UL 1008 tested and labeled with 1.5 or 3 cycle ratings, or that have series or specific upstream breaker ratings only, are not acceptable.

C. Four pole ATSs shall include fully rated, overlapping neutral contacts. The normal power and emergency power neutrals shall only be connected together during transfer and retransfer operations, and only for 100 milliseconds or less.

D. ATSs shall contain readily accessible terminal blocks for connection of external wiring.

E. ATSs shall include a full maintenance bypass and isolation switch section to allow either the normal or the emergency source to directly feed the load while totally isolating all components in the automatic transfer switch compartment from power except from the 120 Volt control power.

1. Bypass isolation switches shall be rated the same as the automatic transfer switches.
2. Bypass isolation switches shall include closed transition (make before break) contacts to avoid power interruptions during transfer and retransfer.
3. Provide manual operators with operating handles capable of being used without opening the enclosure door.

F. ATSs shall be electrically operated and mechanically held with a solenoid operated, momentarily energized electrical operator.

G. ATSs shall be positively locked and unaffected by momentary outages, so that contact pressure is maintained at a constant value.

H. Main switch contacts shall be of silver composition. ATSs rated 600 amperes and above shall have front removable and replaceable contacts, and main contacts shall be protected by separate arcing contacts.

I. Inspection of contacts shall be possible from the front without disassembly of operating linkages and without disconnection of power conductors.

J. ATSs shall be housed in NEMA 1 enclosures with a hinged front door secured by a latch. The door shall open a minimum of 90 degrees. The latch handle shall include provisions for locking in the closed position.

K. Provide a control panel with sensing and control logic directed by a built-in microprocessor.

1. Mount the control panel on the front door of the ATS enclosure. Connect the control panel to the transfer switch with an interconnecting wiring harness. Include a keyed disconnect plug with the harness to enable the control panel to be disconnected from the transfer switch for maintenance.
2. Provide sensing and control logic on printed circuit boards. Provide industrial grade plug-in type interfacing relays with dust covers.
3. Provide monitoring of voltage of each phase of the normal and emergency sources. Provide voltage sensing with pickup voltage adjustable from 85 percent to 100 percent of nominal dropout, adjustable from 75 percent to 98 percent of pickup setting, and independent frequency sensing with pickup adjustable from 90 percent to 100 percent of nominal.
4. Provide a repetitive accuracy of all settings within plus or minus 2 percent over an operating temperature range of minus 22 degrees F to 104 degrees F.
5. Provide voltage and frequency settings that are field programmable in 1 percent increments.
6. Provide a time delay on transfer to emergency power, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.

7. Provide a time delay on retransfer to normal power, adjustable from 0 to 30 minutes. Provide an automatic bypass of this time delay if the emergency source fails and the normal source is acceptable.
8. Provide momentary-type test switches to simulate a normal source failure.
9. Provide terminals for two remote controlling contacts; one that signals the ATS to transfer to emergency and the other to inhibit transfer to emergency and/or retransfer to normal.
10. Provide auxiliary contacts rated 10 amps, 250 VAC, consisting of two contacts that are closed when the ATS is connected to the normal source and two contacts that are closed when the ATS is connected to the emergency source. Wire these contacts to terminals for connection to external wiring.
11. Provide indicating lights for the presence of normal power and presence of emergency power; one showing ATS is connected to the normal source (green) and another to indicate when the ATS is connected to the emergency source (red).

L. Provide one ATS with a system exerciser for automatic exercising and testing of the engine-generator and ATSs. Include the following features.

1. An engine start time clock capable of being programmed for time of day, day of the week, week of the month, months of the year, and duration of the exercising.
2. Time clock shall automatically adjust, resetting itself for changes between Standard Time and Daylight Savings Time.
3. Controls to enable and disable the transfer of the ATSs during engine exercising.

M. Provide engine-generator and ATS manual start and transfer features for installation in the Fire Command Center as required by the Michigan Building Code.

1. Provide one two-position, “Auto-Run” selector switch with one contact per ATS to manually initiate an engine-generator start and ATS transfer. In the “Auto” position, each ATS shall be in normal stand-by mode. In the “Run” position, each ATS shall simulate a loss of normal power. This shall cause each ATS to start the generator(s) and transfer to generator power when its generator is ready.
2. Provide a green “normal power” and a red “generator power” indicating light for each ATS to indicate the position of the ATS. Label each pair of lights to indicate the generator and ATS equipment numbers and the types of loads connected to the ATS.
3. In lieu of providing one “Auto-Run” selector switch and multiple green and red indicating lights, one ATS remote annunciator may be provided. The annunciator shall be from the same manufacturer as the ATSs. It shall include means to manually start the engine-generator and transfer all ATSs, and a green “normal power” and a red “generator power” position indicating light for each ATS.

2.8 LOAD BANK

A. Provide a self-contained resistive load bank suitable for permanent installation outdoors. The load bank shall be rated for 100 percent of generator output at unity power factor, and shall include the following:

1. A weather protective, thermostatically controlled heated housing for contactors and other control components.
2. A heavy-duty blower with integral blower motor.
3. Fixed louvers on exhaust openings capable of exhausting air upward as shown on the Drawings.
4. Corrosion resistant chromium alloy wire resistors.
5. Branch circuit fusing on all load steps.
6. 480V - 120V control power transformer.
7. Load dump circuit to disconnect the load bank automatically upon loss of normal utility power.
8. Remote control panel integral to the load bank enclosure and including the following:
    a. Control power on-off switch.
    b. Control power light.
    c. Blower power light.
    d. Air failure light.
    e. Master load on-off switch.
    f. Load step on-off switches.
    g. Digital multi-function meter displaying instantaneous voltage, current, power, or frequency for all 3 phases.

2.9 LOAD CONNECTION BOX

A. Provide a generator output circuit breaker or generator bus tap located in a connection box for connection of cables to a portable load bank. Size the circuit breaker or bus tap for 100 percent full load current of the generator. Box shall have a grommeted opening sized for the cables and a cover capable of being closed while the cables are connected.

2.10 SOURCE QUALITY CONTROL

A. Before shipment of the equipment, factory test the engine-generator under rated load and power factor for performance and proper functioning of controls and interfacing circuits. Tests shall include:

1. Proper operation of controls, indicators and safety shutdowns.
2. Single step load pick-up per NFPA 110.
3. Compliance with the specified transient and steady state voltage and frequency requirements.
4. Provide a certified factory test report.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Maintain Code and manufacturer defined working clearance around the generator and automatic transfer switches.

B. Install engine-generator on grillage or concrete housekeeping pad as shown with sound isolation pads or springs between mounting surface and generator.

C. Install and orient exhaust pipe rain flapper cap with hinge toward the southwest.

D. Set timers, overcurrent protective devices, and other items needing to be set in accordance with the design documents and manufacturer's directions.

3.2 CONNECTIONS TO REMOTE EQUIPMENT

A. Install the following remote equipment where shown on the Drawings and connect them with wire in conduit to the engine-generator system.

1. Engine-generator emergency stop station.
2. Engine-generator remote annunciator.
3. Engine-generator remote "auto-run" switch and ATS status indicators in Fire Command Center.
4. Load bank.

B. Provide control circuits from the ATSs and fire pump controller to start the engine-generator.

C. Provide control circuits from the engine-generator and ATSs to BAS to provide "generator running", "generator trouble", and ATS "on generator power" alarms. In accordance with NEC 700.3(F), provide a contact point and control circuit to the BAS from the temporary power switching means, to indicate that the "permanent emergency source is disconnected" from the emergency system.

D. Provide control circuits from the soft-loading ATS to its normal power and generator power feeder breaker shunt trip coils. Utilize engine-generator starter battery power to energize the coils.

E. Provide 120 Volt control and miscellaneous power to engine-generator and automatic transfer switch auxiliaries to insure proper operation. Update panel directories and install labels indicating the sources on the auxiliary equipment.

3.3 SYSTEM STARTUP

A. Coordinate with the Plant Operations Call Center at (734) 647-2059 before starting up or testing engine-generators or automatic transfer switches.

B. Notify OSEH at (734) 647-1143 before starting up engine-generators.

C. Prior to any testing, perform visual inspections to verify the following:

1. The equipment is completely and properly installed.
2. The equipment is free from damage and defects.
3. Shipping blocks and restraints have been removed.

4. Electrical terminations have been properly tightened.
5. The equipment has been properly aligned.
6. The equipment has been properly lubricated.
7. The ventilation louvers are open and unobstructed.
8. The equipment is ready to be tested.

D. Perform a continuity check and 1,000 Volt DC Megger test on the generator windings, generator circuit breakers, power circuit portions of the automatic transfer switch, and interconnecting power circuit wiring.

E. Perform a continuity check on the control wiring.

F. Calibrate the metering and time delay relays.

G. Provide a factory-trained technician to check and perform an initial startup of the engine-generator and automatic transfer switches.

H. The manufacturer’s representative shall provide a certificate in writing that the equipment installation and operation meets their requirements and the project design criteria.

3.4 ENGINE-GENERATOR SYSTEM FIELD TESTING

A. Perform a load bank test of the overall system using a resistive load bank or soft-loading automatic transfer switch rated at 100 percent of generator full load for at least 120 minutes.

B. Test the completed engine-generator system in accordance with NFPA 110 and Manufacturer's written instructions.

1. Open normal power to each automatic transfer switch and observe proper operation of engine-generator and automatic transfer switch (throwing over to emergency power), noting engine-generator start, time delays, and other appropriate variables.
2. Restore normal power and observe proper transfer back to normal power and proper shutdown of engine-generator, again noting time delays and other appropriate variables.
3. Operate maintenance bypass switch to ensure proper operation in all modes.
4. Demonstrate each automatic transfer switch in each mode of operation.
5. Demonstrate the automatic test function.

C. Test the operation of engine-generator control and alarm connections to the automatic transfer switches, remote annunciator, Fire Command Center, BAS system, and accessories under all operating conditions.

D. When the engine is not factory certified as compliant with EPA emissions standards, make all modifications and adjustments necessary to obtain field certification.

3.5 COMMISSIONING

A. Perform the commissioning activities per Related Sections.

3.6 TRAINING

A. Provide a qualified service technician from the Manufacturer's staff to provide training.

B. Provide the Owner's personnel with training on equipment operation, start-up and shutdown, trouble-shooting, servicing and preventative maintenance procedures of the engine-generator, automatic transfer switches, and accessories. Do not conduct training until after start up and commissioning is completed. Provide training documents and the approved Operations and Maintenance manuals to the Owner at least two weeks prior to the training to allow sufficient time for review.

1. Provide a minimum of 4 hours of training on the engine-generator.
2. Provide a minimum of 4 hours of training on the automatic transfer switches.

END OF SECTION 263000