SECTION 263215- DIESEL-ALTERNATOR POWER SYSTEM

Use this section when any of the following is applicable:

1. Diesel-alternator unit is expected to supply power for up to 4000 hours annually or up to 40,000 hours during the initial 10 years of operation.

2. The unit powers the entire facility in the event of failure of normal power source.

3. Operates in parallel with existing facility generating equipment.

4. Operates in parallel with power company service.

5. Operates as a peak demand reduction system.

6. Operates as a peak demand reduction and load shedding system see information at end of section.

1. GENERAL

For article below, other related sections may be required such as 055000 - metal fabrications when project is processed as combined single contract (louvers and metal fabrications are provided by construction contractor when project is processed under separate related contracts).

* + - 1. RELATED WORK SPECIFIED ELSEWHERE
				1. Piping and Accessories-Remote Radiator: Section 232005.
				2. Ductwork: Section 233114.
				3. Automatic Transfer Switch: Section 263623.
				4. Fuel Tanks For Diesel-Alternators: Section 335617.
			2. SYSTEM DESCRIPTION
				1. Design Criteria: The diesel-alternator unit is required to:

Supply power for up to 4000 hours annually or up to 40,000 hours during the initial 10 years of operation.

Operate 20,000 hours without major repairs or overhauls, and be completely rebuildable.

Deliver the specified output and have the capability to supply at least 10 percent additional output for up to 2 hours in any 24 hour period.

Operate in coordination with automatic transfer switch.

* + - * 1. Description of System:

The diesel-alternator power system powers the entire facility in the event of failure of normal power source.

In normal operating condition, the mechanism of the transfer switch is in the normal position and the diesel-alternator unit shut down. Sequence of transfer operation occurs as follows:

Upon signal from the automatic transfer switch, the diesel-alternator unit automatically starts.

Maximum 10 second time delay is required for essential electrical systems (nfpa 99). Most projects should be treated as essential and meet this requirement. It can be omitted for non-critical uses when specifically requested.

Units over 1000kw may not be able to meet the maximum 10 second time delay requirement in b. Due to the initial 2 second time delay in the transfer switch plus the time it may take for a large engine and associated equipment to prepare for start and transfer.

Also, units over 1000kw may not be able to successfully pick up full load in one step. Sequencing or load shedding techniques may be employed but should be avoided (consult with manufacturer’s representatives).

Complete transition from onset of normal service failure to diesel-alternator power system transfer shall not exceed 10 seconds.

The diesel-alternator unit continues to run until the related automatic transfer switch signals for the unit shut down.

When any of the following are required, write detailed description and sequence of operation to suit.

The diesel-alternator power system also:

Operates in parallel with existing facility generating equipment.

Operates in parallel with power company service.

Operates as a peak demand reduction system.

Operates as a peak demand reduction and load shedding system.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Waiver of Submittals: The “Waiver of Certain Submittal Requirements” in Section 013300 does not apply to this Section.
				5. Submittals Package: Submit the product data, shop drawings, and quality control submittals specified below all at the same time as a package for preliminary approval. After preliminary approval, perform factory test and submit the factory test report for final approval.
				6. Shop Drawings:

Show the construction (outline) of the diesel-alternator unit and accessories.

Installation details.

Housing details including layout of equipment, raceways, piping, etc.

* + - * 1. Product Data:

Catalog sheets, specifications and installation instructions.

Bill of materials.

Detailed sequence of operations (format similar to 1.02 B. Description of System).

Company’s data indicating fuel consumption with the unit operating at 1/2, 3/4 and full load (include fuel specifications).

Name, address and telephone number of nearest fully equipped service organization.

State where factory test will be held. Include data which proves that equipment available and capabilities of test site are adequate and designed for the tests required, including full load and 110 percent full load tests at .8 PF.

* + - * 1. Quality Control Submittals.

Design Data:

Company’s data indicating HP, KW and KVA ratings with proof that the unit will meet the full load test without exceeding NEMA temperature rise specified at 100 percent & 110 percent full load (.8 PF).

Certified data from the Company proving that the unit will meet the requirements of 1.02 A. Design Criteria.

Torsional stress compatibility analysis for the proposed diesel/alternator combination proving that the torsional stress will not exceed the specified limit.

Ampere requirements of the starting system (at the batteries specified minimum ambient temperature) during cranking.

Include engine manufacturer’s recommended battery ampere-hour capacity at the minimum ambient temperature condition for the specified duration and number of crank cycles.

Include battery manufacturer’s data proving that the batteries will meet the ampere-hour requirements at the batteries minimum ambient temperature.

Include details of battery charger and battery rack recommended by battery manufacturer.

Use 2 subparagraphs below when a remote radiator is used.

Company’s data proving that the method proposed for cooling the exhaust manifold will meet the requirements of 2.01 F.2.

Data proving that the remote radiator meets the engine cooling requirements.

Factory Test Report.

Company Field Advisor Data: Include:

Name, business address and telephone number of Company Field Advisor secured for the required services.

Certified statement from the Company listing the qualifications of the Company Field Advisor.

Services and each product for which authorization is given by the Company, listed specifically for this project.

Completed Installation Lists.

* + - * 1. Contract Closeout Submittals:

Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Director’s Representative. Include name, address and telephone number of nearest fully equipped service organization.

Test Report: System acceptance test report.

Certificate: Affidavit, signed by the Company Field Advisor and notarized, certifying that the system meets the contract requirements and is operating properly.

Use subparagraph below for units over 100kw.

Photographs:

After completion of the work take color photographs of the completed Work of this Section, as follows:

3 of Diesel-alternator from different positions.

1 overall view of diesel-alternator.

2 of remote radiator (one from each side viewed through open door showing connections and motor drive).

Nameplate(s)

Use a digital camera.  Use wide angle lens for overall view.  Use electronic flash capable of supplying sufficient light to evenly illuminate the overall subject.

Minimum digital requirements:

Format shall be .jpg or .tif

The resolution shall be 12 Megapixels or greater.

Submit photographs to electronic submittal website for approval and record.

* + - 1. QUALITY ASSURANCE
				1. Equipment Qualifications For Products Other Than Those Specified:

At the time of submission provide written notice to the Director of the intent to propose an “or equal” for products other than those specified. Make the “or equal” submission in a timely manner to allow the Director sufficient time to review the proposed product, perform inspections and witness test demonstrations.

If products other than those specified are proposed for use furnish the name, address, and telephone numbers of at least 5 comparable installations that can prove the proposed products have performed satisfactorily for 3 years. Certify in writing that the Director’s Representative of the 5 comparable installations will allow inspection of their installation by the Director's Representative and the Company Field Advisor.

Make arrangements with the Director’s Representative of 2 installations (selected by the Director) for inspection of the installations by the Director's Representative. Also obtain the services of the Company Field Advisor for the proposed products to be present. Notify the Director a minimum of 3 weeks prior to the availability of the installations for the inspection, and provide at least one alternative date for each inspection.

Only references from the actual Director or Director’s Representative (Security Supervisor, Maintenance Supervisor, etc.) will be accepted. References from dealers, system installers or others, who are not the actual Director’s Representative of the proposed products, are not acceptable.

Verify the accuracy of all references submitted prior to submission and certify in writing that the accuracy of the information has been confirmed.

The product manufacturer shall have test facilities available that can demonstrate that the proposed products meet the contract requirements.

Make arrangements with the test facility for the Director's Representative to witness test demonstrations. Also obtain the services of the Company Field Advisor for the proposed product to be present at the test facility. Notify the Director a minimum of 3 weeks prior to the availability of the test facility, and provide at least one alternative date for the testing.

Provide written certification from the manufacturer that the proposed products are compatible for use with all other equipment proposed for use for this system and meet all contract requirements.

* + - * 1. Source Quality Control: The Company producing the diesel-alternator unit shall have test facilities available which can demonstrate that the proposed system meets contract requirements.

Use paragraph below when the operating cost is the major factor for installing the system such as heat recovery or peak demand reduction.

* + - * 1. Maximum Fuel Consumption: If the unit is found to consume more fuel than the average gallons per hour stated in Part 2, the Contractor will be required to return to the State a sum of money that is equal to the cost of the fuel used in excess of the amount that would have been consumed at the specified consumption rate over the anticipated life of the unit. The financial adjustment will be determined on the basis of fuel consumption tests and will be deducted from the final payment, using the following criteria:

Fill in blanks in subparagraph below, adjust other figures as required. Delete underlining before entering information.

Assumed number of operating hours per year at full load \_\_\_\_\_\_\_\_; 3/4 load \_\_\_\_\_\_\_\_; 1/2 load \_\_\_\_\_\_\_\_.

Assumed anticipated useful life of the unit: 15 years.

Assumed cost of fuel: $1.05 per gallon.

Edit number of hours in paragraph below as required.

* + - * 1. Company Field Advisor: Secure the services of a Company Field Advisor for a minimum of 24 working hours for the following:

Render advice regarding installation and final adjustment of the system.

Witness final system test and then certify with an affidavit that the system is installed in accordance with the contract documents and is operating properly.

Edit number of sessions and hours in subparagraph below as required.

Train facility personnel on the operation and maintenance of the system (minimum of two 2 hour sessions).

Explain available service programs to facility supervisory personnel for their consideration.

* + - * 1. Service Availability: A fully equipped service organization capable of guaranteeing response time within 8 hours to service calls shall be available 24 hours a day, 7 days a week to service the completed Work.
				2. Factory Test:

Test facility shall be:

Sheltered from precipitation.

A minimum of 50 degrees F.

Safe from electric hazard for test observers.

Preparation: The unit shall be completely assembled and all preliminary adjustments made before the factory test is initiated.

Run unit long enough to assure the unit is running properly.

A suitable muffler and radiator, if available at the test site, may be used for the factory test in lieu of delivering the project muffler and radiator to the test site.

Run a preliminary test for the purpose of:

Determining whether the unit is in suitable condition to conduct the factory test.

Checking the test setup and equipment to verify that all required test data can be obtained during the factory test.

Two representatives of the State shall witness factory test of the diesel-alternator unit.

Notify the Director’s Representatives at least 2 weeks in advance of test.

Have sketch or diagram available showing how test equipment is connected, including metering, pt’s, ct’s, and power transformers (if used).

Have metering located so that they are easily observable.

The object of the factory test is to determine:

The net power output.

That fuel consumption does not exceed specified limit.

Use subparagraph above when 1.04 c. Is required, otherwise use subparagraph below.

Fuel consumption.

That diesel-alternator operational functions are within specified parameters.

That alternator temperature rise does not exceed specified limit (test at .8 PF).

Schedule of Tests:

Test diesel-alternator unit at .8 PF in the following sequence:

1/2 hour at half load.

1/2 hour at 3/4 load.

2 hours at full load.

2 hours at 110 percent full load.

1 hour at full load.

Run each load test segment continuously. Run all load test segments consecutively with no steps or delays between each test segment.

Measurements, Observations and Data:

Provide the following information:

Barometric pressure.

Intake air temperature.

Speed in revolutions per minute.

Frequency in cycles per second.

Output voltage (per phase).

Output amperes (per phase).

Power factor.

Gross kilowatts output.

Gross kilowatt-hours during test period.

Temperature of alternator windings at full load and 110 percent full load.

Fuel rate (gph).

Fuel characteristics (weight per gal & BTU/lb).

Before each test, bring the engine to a steady state under the condition of the test. The attainment of steady state is to be determined by readings which are to be made part of the record.

During each test period, take readings and record results at the beginning and end of test and at 15 minute intervals during test.

Demonstrate that:

Unit maintains precise isochronous control.

Voltage regulation and transient voltage dip are within specified parameters.

Stable alternator operating conditions are reestablished within specified parameters between no load/full load.

Perform tests under the supervision of a factory engineer.

Submit factory test report for approval. Do not ship unit to site until final approval is received.

Instruments and Apparatus:

Provide the following instruments and apparatus for the tests (available instruments at the factory may be used to the extent possible):

Tanks, scales or meters arranged for measuring fuel consumed.

Pressure gages.

Temperature measuring devices.

A tachometer or frequency indicator.

A stop watch or electrical timing apparatus.

Electrical instruments to measure kilowatts, volts, amperes, power factor and gross kilowatt-hour output of the unit.

Steady load of uniform power factor (.8) for simulated load conditions.

Instruments and apparatus shall have recent calibration certification. Make available data that certifies the dates the instruments and apparatus have been calibrated.

* + - 1. PROJECT CONDITIONS
				1. The diesel-alternator unit shall meet all requirements at the following elevation and ambient temperatures (actual site conditions):

Fill in blanks in next 3 subparagraphs as required. Maximum ambient should be the temperature of the room or enclosure when the unit is running. Coordinate with HVAC. Delete underlining before entering information.

Elevation Above Sea Level: \_\_\_\_\_\_\_\_ feet.

Maximum Ambient Temperature: \_\_\_\_\_\_\_\_ degrees F.

Minimum Ambient Temperature: \_\_\_\_\_\_\_\_ degrees F.

* + - 1. MAINTENANCE
				1. Spare Parts:

Two sets of gaskets for routine engine maintenance.

Two spare heating elements for water jacket heater. Furnish spare water jacket heater if elements are not replaceable.

Set of belts.

Set of oil filter elements.

Set of fuel filter elements.

Set of air cleaner elements.

Hydrometer for testing anti-freeze solution.

Test kit for checking chemical condition of coolant.

One year supply of coolant conditioner.

Special tools if required for the regular maintenance and minor repairs of the unit.

1. PRODUCTS
	* + 1. DIESEL-ALTERNATOR UNIT

Fill in blanks in paragraph below. Example: 500kw (625kva at .8 pf).when elevators are to be connected to the system, check with elevator designers to verify that there is sufficient load to overcome regenerative effect from elevator motors. Delete underlining before entering information.

* + - * 1. Rating: \_\_\_\_\_\_\_\_ KW (\_\_\_\_\_\_\_\_ KVA at 0.8 power factor), 120/208 volts, 3 phase, 4 wire, 60 Hertz. (Note: Unit is required to meet 110 percent full load test at .8 PF for 2 hours).

Edit companies in paragraph below for size range: caterpillar 50 kw to 1300 kw, cummins/onan 3kw to 1500kw, detroit diesel 45 kw to 1100 kw, general electric 1500 to 2800 kw, kohler 4 kw to 1500 kw, onan 3 kw to 1000 kw, waukesha 80 kw to 1375 kw.

1. Kw ranges indicated for each company are for very general guide only. Each company may or may not have sizes available to meet our full load kw requirement plus 110 percent full load.

2. Each company specified may not meet every aspect of this specification, depending upon final application.

3. Check with company representative after project parameters have been established.

* + - * 1. Acceptable Companies: Caterpillar Tractor Co., Cummins Engine Co. Inc., Detroit Diesel Allison, Kohler Co., General Electric Co. - Diesel Products Power, or Onan Div. - Onan Corp.
				2. Base: Rigid, electrically welded structural steel base with diesel-alternator mounted directly thereon complete with spring type vibration isolators, provisions for foundation bolts and provisions for lifting entire unit.
				3. Engine:

Industrial type diesel engine, turbocharged, water cooled, pressure lubricated, 1800 rpm maximum, full diesel with mechanical fuel injection. Engine shall be capable of starting cold, solely from the heat of compression, operating on No. 2 diesel fuel.

Torsional stress of the engine crankshaft and alternator rotor shaft shall not exceed 5000 pounds per square inch when operating as an assembled unit at rated speed and power output.

Fill in blanks in subparagraph below see information at end of section. Include gph at 3/4 & 1/2 load only when 1.04 c. is used. Delete underlining before entering information.

Maximum average fuel consumption: (Fuel based on 19,350 BTU/lb, 7.3 lbs per gal.)

\_\_\_\_\_\_\_\_ gallons per hour at rated full load.

\_\_\_\_\_\_\_\_ gallons per hour at 3/4 load.

\_\_\_\_\_\_\_\_ gallons per hour at 1/2 load.

Engine Accessories: Equip engine with company’s standard accessories. Exception: In addition to, or in lieu of the company’s standard accessories for the following, equip engine with:

Other type starting systems must be considered (such as air start) in subparagraph below due to size of unit and frequency of starting. Specification sections and details for air starting system are available in the office.

Electric starting system, 24 V dc minimum.

Fuel filters, spin on type.

Heavy duty air cleaners are available for subparagraph below, for extreme conditions.

Dry type air cleaner (replaceable element).

Manual priming pump for fuel.

Use either of the next 2 subparagraphs. Use subparagraph below for standard application.

Motor driven pre-lube pump unless recommended otherwise by engine manufacturer. Pump to start and build up sufficient oil pressure before engine is cranked. Pre-lube pump parameters (pressure, flow, etc.) as recommended by engine manufacturer.

Use subparagraph below when the unit will start frequently or when engines are adjacent (vibration tends to pound oil out of bearings of a shut down engine when the other engine is running).

Motor driven pre-lube pump. Pump to run continuously when engine is shut down. Pre-lube pump parameters (pressure, flow, etc.) as recommended by engine manufacturer.

Lubricating oil filters, full flow (with by-pass valve), spin-on type.

Oil dipstick system that allows lubricating oil level to be checked while engine is running and stopped.

Governor which maintains speed at precise isochronous control for 60 Hz operation. The frequency at any constant load (including no load) shall remain within a steady state band width of + 0.25 percent of rated frequency. Frequency modulation (defined as the number of times per second that the frequency varies from the average frequency in cyclic manner) shall not exceed one cycle per second.

* + - * 1. Engine Control and Instrumentation:

Timer for selective number of cranking cycles.

Circuit for bypassing oil pressure protective device during starting.

Selector switch for stop, automatic and manual positions.

Indicating Instruments and Safety Devices:

Audible alarm to sound when any safety device operates.

High water temperature cutout and indicating light.

Low lubricating oil pressure cutout and indicating light.

Overspeed shutdown and indicating light.

Overcranking cutout and indicating light.

Alarm system reset.

Lamp test switch.

Fuel pressure gage (injection pump).

Lubricating oil pressure gage.

Jacket water temperature gage.

Running time meter.

Sensor and warning device to indicate jacket water temperature below 70 degrees F.

Charging pressure gage (turbocharged engine).

Lubricating oil temperature gage.

Differential oil pressure gages on fuel filters and lubricating oil filters.

Review need for pyrometer in subparagraph below (measures exhaust temperature of each cylinder, indicating which cylinder fuel supply may need repair or adjustment). This feature is not available on all size engines. Would be most beneficial when 1.04 c. Is required.

Master Pyrometer (multipoint with individual cylinder thermocouples).

Use next 2 subparagraphs only when cooling system is other than standard unit mounted radiator (remote radiator or heat exchanger).

Inlet water temperature gage.

Outlet water temperature gage.

Use either (or both) of the next 2 subparagraphs., only available for units 200kw and above.

Weak battery (alarm).

Low fuel daytank (alarm).

Auxiliary contacts or relays to control opening and closing of motorized dampers.

Use subparagraph below when 2.06 is required.

Provisions for remote annunciation.

Engine gages and control switches may be installed directly on an engine mounted panel or on instrument panel of an engine starting control panel.

Locate panel so that it may be observed conveniently by Facility operating personnel.

Omit subparagraph below if unit is installed in heated area.

Equip panel with strip heater to control condensation.

* + - * 1. Engine Cooling and Heating Equipment:

Use 1. Thru 3. Or 4. Thru 7.

Use 1. Thru 3. For remote radiator. All information is for vertical remote radiator. Verify catalog number (to suit installation). Details and specifications for piping available in office (15070).

Remote Radiator: Inland Engine Accessories Inc.’s VC Series:

Cooling capacity as recommended by engine manufacturer.

Motor specified in subparagraph below. Is only suitable to -20 degrees f. A special artic type motor is required for under -20 degrees f.

Electric fan motor suitable for operation on a 208 volt, 3 phase, 60 Hz circuit.

Automatic, reduced voltage, magnetic motor controller; Cutler-Hammer Inc.’s File A400-9621, General Electric Co.’s CR-131, Westinghouse Corp.’s Class 11-600.

If a horizontal radiator is needed to suit project conditions:

1. A snow roof should be used in heavy snow areas.

2. Consult with company representatives because the parameters specified for a vertical radiator do not necessarily apply to a horizontal radiator. Change to horizontal mounting in subparagraph below if required. Verify all parameters.

Cooling core mounted vertically.

Factory test pressure of 20 pounds per square inch, operating pressure as required by the engine manufacturer.

Maximum operating temperature of 250 degrees F.

Cooling core guard.

OSHA approved fan guard.

Surge tank as recommended by radiator manufacturer.

Sight glass for coolant level indication.

Spring type vibration isolators.

Water cooled exhaust manifold or other suitable means (insulating blankets, etc.) to protect personnel from hot exhaust parts, to prevent excessive heat rejection to the room from the exhaust manifold and to prevent excessive heat build-up in engine and accessories due to lack of cooling air flow over engine and accessories.

Permanent type anti-freeze (ethylene glycol) for the cooling system; Dow Chemical Co.’s Dow Therm SR-1. Coolant mixture suitable for use to minus 50 degrees F.

Use 4. Thru 7. For engine mounted radiator.

Engine mounted radiator system and pusher type fan designed to cool the jacket water and lubricating oil.

Use subparagraph below if unit is being used for heat recovery.

Water cooled exhaust manifold.

Radiator flange for duct connection.

Permanent type anti-freeze (ethylene glycol) for the cooling system by Dow Chemical Co. or Union Carbide. Coolant mixture suitable for use to minus 50 degrees F.

Use next 3 subparagraphs for all units.

Coolant conditioner corrosion prohibitive chemical additive which controls acidity, softens water and leaves protective film on cooling passages. Type and method of application as recommended by engine manufacturer.

Thermostatically controlled electric water jacket heater in the cooling system to maintain engine temperature at minimum 70 degrees F.

Lube oil cooler.

* + - * 1. Engine Exhaust Equipment:

Silencer specified in subparagraph below is suitable for all areas including critical noise areas.

Silencer: Suitable for critical noise areas; Burgess-Mannings’ BEO, Donaldson Co. Inc.’s TCU, Riley-Beaird Inc.’s Maxim Model M51, or Universal Silencer’s EN5 with:

Flanges.

Omit subparagraph below for outdoor housed units.

Hangers and supports (vibration isolation type).

Use 2. & 3., or 4. Use 2. & 3. For standard application. Use 4. For office buildings or other applications requiring more aesthetic appearance. Omit 2., 3., & 4. For outdoor housed unit. Consult manufacturer’s catalog for drawing details.

Exhaust Pipe: Schedule 40 black steel pipe with:

Corrugated stainless steel flexible section for connection between exhaust manifold and exhaust pipe.

Omit next 2 subparagraphs for outdoor housed units.

Hangers and supports.

Omit subparagraph below for short exhaust pipe runs.

Condensate drain at low point.

Use one of next 2 subparagraphs.

Rain cap (vertical pipe).

Bird screen (horizontal pipe).

Insulation: 3 inch thick calcium silicate pipe insulation; Manville’s Thermo-12, or Owens-Corning’s Kaylo with Type 304 stainless steel metal jacketing, .010 inch thick, held in place with snap-in locking joints and stainless steel bands with snap straps.

Exhaust Pipe: Selkirk Metalbestos Model PS Diesel Engine Exhaust System.

If a high voltage alternator is required for h., it may take 12 to 14 months for delivery. Consult manufacturers.

* + - * 1. Alternator and Accessories: Multipole, revolving field alternator meeting NEMA Standards, having:

Brushless solid state permanent magnet (PMG) exciter system.

Temperature compensated solid state voltage regulator. Voltage regulation within plus or minus 2 percent of rated voltage from no load to full load. Transient voltage dip not greater than 20 percent of rated voltage when full load at rated power factor is applied to the alternator.

Stable alternator operating conditions re-established within 2 seconds following any change in load between no load and full load or between full load and no load.

Use one of next 2 subparagraphs. Use subparagraph below for standard application.

Temperature rise in accordance with NEMA MG1-22.40, determined by resistance method, rated on continuous basis at full load and standby basis at 110 percent full load, reference ambient temperature 40 degrees C, .8 PF:

|  |  |  |
| --- | --- | --- |
| **INSULATION SYSTEM** | **RISE (Full Load)** | **RISE (110 Percent Full Load)** |
| Class B | 80 degrees C | 105 degrees C |
| Class F | 105 degrees C | 130 degrees C |
| Class H | 125 degrees C | 150 degrees C |

Use subparagraph below for more demanding applications requiring highest overload capability, longest life and least electrical losses.

Temperature rise in accordance with NEMA MG1-22.40, determined by resistance, rated on continuous duty basis at 110 percent full load, reference ambient temperature 40 degrees C, .8 PF:

|  |  |
| --- | --- |
| **INSULATION SYSTEM** | **MAX. RISE AT 110 PERCENT FULL LOAD** |
| Class B | 80 degrees C |
| Class F | 105 degrees C |
| Class H | 125 degrees C |

Review need for subparagraph below (provides warning for damaging overload condition). This feature not available for all size alternators. Show warning bell and wiring on the drawings. Note: thermocouples should be included when available to aid in determining the temperature rise during the factory test.

Imbedded temperature measuring detectors in the windings (thermocouples or resistance thermometers) with control unit and accessories for direct reading of stator temperatures (2 detectors per phase). Alarm shall sound at temperature recommended by alternator manufacturer.

Use subparagraph below for alternator installed in unheated enclosure or building.

Alternator heating units as recommended by alternator manufacturer to maintain the temperature of the alternator at 5 degrees above the ambient.

Rheostat for plus or minus 5 percent voltage adjustment.

Amortisseur windings, suitable for paralleling.

Alternator directly connected to engine and driven through a semi-flexible driving flange.

For subparagraph below, remember to include section 262817 for small and medium capacity low voltage applications. Large capacity low voltage and high voltage systems will require switchgear type equipment.

Main circuit breaker mounted on unit, or on mounting frame adjacent to unit. Circuit breaker shall meet the requirements of Section 262817 - Enclosed Circuit Breakers. Field circuit breaker not acceptable as the main circuit breaker.

Instruments in panel, shock mounted on the unit:

Dial type frequency meter.

Rheostat Control.

AC voltmeter.

AC ammeter.

Individual or combination type selector switches for the voltmeter and ammeter.

Panel lights and switch.

* + - 1. BATTERIES AND ACCESSORIES
				1. Nickel-cadmium batteries; Hoppeke Battery Systems Inc.’s FNC, Marathon’s Alcad UHP, McGraw Edison Power Systems Div.’s Americad HED, or SAB Nife Inc.’s Block Battery Type H, with:

Number of cell units as required for voltage of starting system. (Cell voltage shall be based on 1.2 volts per cell.)

Plastic cell containers.

Use one of next 2 subparagraphs. Use subparagraph below for essential electrical system (nfpa 99).

Ampere-hour capacity as recommended by engine manufacturer for a minimum of 3 consecutive starting attempts of 15 seconds each.

Ampere-hour capacity as recommended by engine manufacturer for 60 seconds of continuous cranking. Note: Engine overcrank device shall terminate cranking with enough reserve power to permit additional cranking after an investigation to find the reason for a failure to start.

Change 32 degrees f. In subparagraph below to lowest temperature batteries will be exposed to.

Full ampere-hour capacity delivered at ambient temperature of 32 degrees F.

* + - * 1. Battery Charger: Constant voltage, current limiting type as recommended by the battery manufacturer, having:

Fully automatic, 2 rate (float and high-rate/equalize) charging control.

DC ammeter.

DC voltmeter.

High-rate indicator light.

Use 5. & 6., or 7. 5. & 6. Are for essential electrical system (NFPA 99).

Common audible alarm and individual indicating lights (with provision for connection to remote annunciator) for:

Ground fault (if ungrounded type dc system).

AC input failure.

Low dc voltage.

High dc voltage.

No dc voltage at batteries.

Remote annunciator panel with common audible alarm and individual indicating lights for:

Ground fault (if ungrounded type dc system).

AC input failure.

Low dc voltage.

High dc voltage.

No dc voltage at batteries.

Use subparagraph below for standard application.

Common audible alarm and individual indicating lights for:

Ground fault (if ungrounded type dc system).

AC input failure.

Low dc voltage.

High dc voltage.

No dc voltage at batteries.

* + - * 1. Battery Rack: As recommended by battery manufacturer.

Use article below for unit installed within a building. Investigate use of security fencing to prevent tampering with the unit (omit the housing).

* + - 1. HOUSING
				1. Factory installed housing, completely enclosing unit, having:

Minimum 16 gage sheet steel construction. All metal painted with rust inhibiting primer and minimum 2 coats of finish paint.

Louvered openings in both sides plus screened, free openings at base, for heat removal air flow.

Front flange for connection to ductwork.

Two removable doors on each side to allow access to the unit.

Rear housing panel with hinged door to allow access to the instrument panel.

Use article below for unit installed outside of building in mild areas of the state.

* + - 1. HOUSING
				1. Custom fabricated weather protective housing to completely enclose unit, by Chillicothe Metal Co. or Pritchard Brown, having:

All equipment and devices installed within the housing (except muffler) including main circuit breaker, day tank, batteries, panelboard, etc. connected and ready for use as complete package.

Welded and bolted sheet steel construction, minimum 16 gage reinforced with welded, stiffened channels, or minimum .050 aluminum construction.

Minimum 40 pounds per sq. ft. snow loading for roof.

Floor plate (minimum 14 gage) and/or end shields to make housing rodentproof.

Electric motor-operated shutters with wire mesh screens at 3 locations (each side of alternator end and front at radiator end).

Size shutters for required air flow at maximum ambient.

Shutters shall automatically open when the unit is operating.

Shutters to open in same direction as air flow.

Shutter in front of radiator shall be modulating type controlled by a temperature controller, adjusted to allow some of the radiated heat of the engine to be captured inside the housing. Set the modulating shutters in relation to the temperature controller as recommended by engine manufacturer.

Two full height doors on each side to allow access to the unit. Doors hinged to housing with full length continuous brass or stainless steel piano hinge.

Large single door at rear housing panel.

All doors hinged and equipped with key-lock door handles.

All metal painted with rust inhibiting primer and minimum 2 coats of finish paint.

Fuel heater in day tank, thermostatically controlled (maintain fuel temperature at 40 degrees F.).

Batteries mounted in a heated, insulated enclosure.

Battery Heaters: by Kim Hotstart Mfg., with thermostat to maintain the air temperature around the batteries at 60 degrees F minimum and 80 degrees F maximum at an outside ambient of -20 degrees F.

Oil and water drains and crankcase vent piped to outside of enclosure.

Silencer mounted horizontally on top of unit, above housing.

All wiring from auxiliary equipment (battery heaters, day tank, motor-operated shutters, water jacket heater and oil heaters) to diesel-alternator panelboard installed in rigid steel conduit.

Type NC emergency lighting unit. Locate light switch for emergency lighting at each door. Light switch shall interrupt AC power to emergency lighting unit, thereby illuminating emergency lighting.

CO2 type fire extinguisher, minimum 15 pound unit by the Amerex Corp., Fire-End & Croker Corp., or Kidde Fire Extinguisher Co.

Subparagraph below is an example of additional features that should be specified when sound attenuation is desired. Examples of relative enclosure cost for 750kva unit.

1. Not sound attenuated $18,000.

2. 25dba attenuation $35,000.

3. 32dba attenuation $42,000.

Special “quiet site” models are available in sizes up to 150kw.

Entire enclosure sound attenuated, 25dbA reduction at one meter from the enclosure walls, as measured in a free field.

Each opening sound protected.

Interior of housing treated with fire resistant sound abatement material, and lined with 22 gage perforated mill finish aluminum.

Spring type vibration isolators at strategic locations recommended by the housing manufacturer.

Silencer and exhaust sound treated, mounted on enclosure as recommended by enclosure manufacturer.

Other sound abatement materials and design features as recommended by the housing manufacturer.

Use article below for unit installed outside of building in areas subject to extreme environmental conditions. Also investigate use of heated, insulated constructed or prefab buildings.

1. Show size of enclosure on the drawings. Indicate walk around space of minimum 3 feet on each side of engine and 4 feet at alternator end of unit.

2. Show lighting, outlets, panelboard, etc.

3. Details available in the office.

* + - 1. HOUSING
				1. Custom fabricated, walk-in, extreme condition weatherproof housing to completely enclose unit, by Chillicothe Metal Co. or Pritchard Brown, having:

Edit subparagraph below for equipment to be installed in enclosure.

All equipment and devices installed within the housing (except muffler) including main circuit breaker, day tank, batteries, panelboard, etc. connected and ready for use as complete package.

Base:

Minimum 6 inch channel iron with minimum 4 inch x 11 gage formed crossmembers.

Painted with black epoxy (6 mil).

Lifting hooks.

Grounding lugs.

Rodentproof skirt.

Floor:

Exterior grade 3/4 inch plywood.

12 gage steel overlay over plywood. Steel overlay covered with anti-slip surface; Garon Products Co.’s Stop Slip.

Skid base of diesel-alternator unit bolted to floor.

Walls and Roof:

Minimum .050 aluminum exterior panels. Color of exterior - white.

Furring strips.

3 inch foam insulation (R value 19.8).

18 gage galvanized steel interior lining or .050 aluminum.

Minimum 60 pounds per sq. ft. snow loading for roof.

One 36 inch and one 48 inch insulated exterior door (one door in each side of housing). Doors equipped with interior panic bar and key lock exterior latch handle. Key locks - Yale #511S with #47 keys.

Thermostatically controlled 5KW electric space heater.

Two fluorescent lights. 3-way switching at each door.

Type NC emergency lighting unit (see Section 265200). Locate light switch for emergency lighting at each door. Light switch shall interrupt AC power to emergency lighting unit, thereby illuminating emergency lighting.

Two motorized air intake louvers with insect screens. One louver for ventilation, controlled by roof exhaust fan thermostat. One louver for combustion air, controlled by engine panel.

Roof mounted exhaust fan (24 inch) with thermostat control.

Emergency stop button at each door.

Oil and coolant piped to outer perimeter of engine.

Crankcase breather and day tank vented to outside of housing.

Exhaust silencer with tail pipe and bird screen, mounted horizontally on top of unit, above housing.

Coordinate subparagraph below with 2.01 f. (delete engine mounted radiator system).

Radiator and Fan:

Mounted remotely in separate compartment on extension of housing base.

Isolated from engine compartment with metal partition (no fan air flow through engine compartment).

Roof extended to cover radiator.

Wire mesh side panels (for air intake), hinged for access.

Gravity louver in front of radiator.

Electric motor driven fan. Motor starter mounted in engine compartment.

Light and switch in radiator compartment.

Engine or wall mounted control panel.

Edit panelboard designation in next 2 subparagraphs as required.

Panelboard (LP-GEM).

All wiring from auxiliary equipment (day tank, motor-operated louvers, lighting, receptacle outlets, water jacket heater, electric space heater, etc.) to diesel-alternator panelboard LP-GEM installed in rigid steel conduit.

CO2 type fire extinguisher, minimum 15 pound unit by the Amerex Corp., Fire-End & Croker Corp., or Kidde Fire Extinguisher Co.

* + - 1. ENGINE FUEL EQUIPMENT

50, 100, 275 gallon tanks are available for a. Size day tank for minimum of 2 hour fuel requirement. Also, day tank must be large enough to prevent overheating the fuel in the day tank. Possible alternatives to larger day tank:

1. Run return line from engine back to the main tank.

2. Install oil cooler in the engine return line to day tank.

* + - * 1. Day Tank: Simplex Inc.’s SFT Series Day Tank System, or Tramont Corp.’s Model TR Day Tank System, with:

25 gallon capacity.

Auxiliary hand pump, rotary type, 5 gpm capacity.

Omit subparagraph below for tanks over 100 gallons (large tanks are floor mounted).

Wall mounting brackets or pipe stand adapters.

Selector switch “Run-Off-Auto”.

Input circuit suitable for operation on single phase 120 V ac.

* + - * 1. Fuel storage tank - See Section 335617.
				2. Provide labeled fill cap or metal plaque set in concrete pad near fill pipe stating “Diesel Fuel”.

Use article below for unhoused unit within a building. (a fire extinguisher is included and specified with housed units).

* + - 1. FIRE EXTINGUISHER
				1. CO2 type fire extinguisher, minimum 20 pound unit by the Amerex Corp., Fire-End & Croker Corp., or Kidde Fire Extinguisher Co.
1. EXECUTION
	* + 1. INSTALLATION
				1. Connections: Make all connections to unit with flexible connections designed for the specific purpose.
				2. Diesel Fuel:

Provide diesel fuel as required to initially fill the fuel storage tank and day tank before commencing the preliminary system test.

Upon completion of all tests provide additional diesel fuel as required to fill the fuel storage and day tank.

Diesel fuel shall have characteristics as recommended by the diesel-alternator unit engine manufacturer.

* + - * 1. Phase Relationship: Correctly phase emergency and normal service so that motor rotation will not reverse upon transfer from normal to emergency feeder.
			1. FIELD QUALITY CONTROL
				1. Preliminary System Test:

Preparation: Have the Company Field Advisor adjust the completed system (with the contract automatic transfer switch connected). Coordinate with automatic transfer switch company field advisor preliminary switch/system test requirements. Operate it long enough to assure that it is performing properly.

Run a preliminary test for the purpose of:

Determining whether the system is in a suitable condition to conduct an acceptance test.

Checking and adjusting equipment.

Training Facility personnel.

* + - * 1. System Acceptance Test:

Preparation: Coordinate test with automatic transfer switch manufacturer and notify the Director’s Representative at least 3 working days prior to the test so arrangements can be made to have a Facility Representative witness the test.

Make the following Tests:

Test each system function step by step as summarized under SYSTEM DESCRIPTION.

Test starting system and battery capacity. Crank engine for the required time and number of consecutive starting attempts.

Edit load bank connection in subparagraph below to suit project requirements. Make sure load banks are available or specified as required.

Load Test: Using the facility system as load to the extent possible plus supplemental load banks, run the following test at rated voltage:

Four hours at full load. Provide supplemental load banks to bring load to full rating of diesel-alternator unit (load not to exceed rating of unit). Connect the supplementary load banks to the secondary side of selected pad mounted transformers.

During the test period take voltage, current, frequency and all engine instrument readings. Record results at the beginning and end of test and at fifteen minute intervals during test.

Supply equipment necessary for system adjustment and testing.

Submit written report of test results signed by Company Field Advisor and the Director’s Representative. Mount a copy of the final report in a plexiglass enclosed frame assembly adjacent to the engine instrument panel.

END OF SECTION 263215

The remainder of this section is for information only; not to be included in project specifications.

 1. Codes, standards and references applicable to the installation of diesel-alternators:

 a. State Building Construction Code: General Building Construction

1032.

 b. NFPA-37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.

 c. NFPA 110 - Standard for Emergency and Standby Power Systems.

 d. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications.

 e. EGSMA (Electrical Generating Systems Marketing Assoc.).

 f. Dema (Diesel Engine Manufacturer’s Assoc.).

 g. NEC (art. 517, 700, 701, 702).

 h. NFPA 99 Standard for Health Care Facilities - Essential Electrical Systems.

 i. NFPA 101 - Life Safety Code.

 2. Refer to standard dwg. No. 83/e-l for installation design details.

 3. Diesel-alternator should be sized so that it will be fully loaded. In no case should a unit be sized so that it will be less than 40 percent loaded. An unloaded diesel engine is prone to wet-stacking (unburned fuel running out of the exhaust pipe) and internal carbon fouling which may cause fuel injector and piston ring damage.

 4. Maximum average fuel consumption (full load):

| Kw | Gph | Kw | Gph | Kw | Gph |
| --- | --- | --- | --- | --- | --- |
| 50 | 4.8 | 175 | 13.9 | 400 | 30.5 |
| 60 | 5.5 | 200 | 15.8 | 450 | 33.0 |
| 75 | 6.3 | 230 | 18.1 | 500 | 36.0 |
| 100 | 8.1 | 250 | 19.0 | 600 | 44.0 |
| 125 | 10.0 | 275 | 20.3 | 750 | 56.0 |
| 135 | 10.8 | 300 | 22.2 | 1000 | 74.0 |
| 150 | 11.8 | 350 | 25.5 |  |  |

 5. Exhaust system: show details (including sizes) of exhaust piping on drawings. Calculate exhaust back pressure of entire exhaust system to verify that back pressure does not exceed engine manufacturer’s limits. See manufacturer’s catalogs for calculation methods.

 6. Fuel supply:

 a. In section 335617 specify no. 2 diesel fuel for the tank charge. Do not use furnace oil for diesel engines. Furnish separate fuel storage tank for engine.

 b. Do not install common suction lines to run 2 or more engines. Common return lines are acceptable.

 c. For details of fill, extractor, supply piping, etc. Refer to standard drawing for installation details. Coordinate with section 335617 and edit the fittings that conflict with those shown on the standard drawing.

 d. Install tank of sufficient capacity for minimum of 72 hours fuel supply.

 e. Certain areas (such as suffolk county) may require special types of tank installations. Check with plumbing engineers.

END OF INFORMATION 263215