

ANSI/ASAE EP364.4 FEB2013 (R2018)
Installation and Maintenance of Farm Standby Electric Power



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Installation and Maintenance of Farm Standby Electric Power

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1 Purpose and Scope

1.1 The purpose of this Engineering Practice is to provide information to assist installers, maintenance personnel, operators and others in the proper installation, operation, and maintenance of farm standby electrical systems.

1.2 The scope of this Engineering Practice covers both engine-driven and tractor-driven generators for farm standby electrical power service as defined in EGSA-101G, EGSA-101S, and EGSA-101P. The terms generator and alternator may be used interchangeably in this Engineering Practice.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Engineering Practice. The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies unless noted. For undated references, the latest approved edition of the referenced document (including any amendments) applies.

ANSI/ASAE S493, Guarding for Agricultural Equipment

ASAE S207, Operating Requirements for Tractors and Power Take-Off Driven Implements

ASAE S318, Safety for Agricultural Field Equipment

EGSA 101G, Glossary of Electrical and Mechanical Terminology and Definitions

EGSA 101P, Performance Standard; For Engine Driven Generator Sets

EGSA 101S, Guideline Specifications for Engine Driven Generator Sets; Emergency and Standby

NFPA 30, Flammable and Combustible Liquids Code

NFPA 31, Standard for the Installation of Oil-Burning Equipment

NFPA 54 (ANSI Z223.1), National Fuel Code

NFPA 58, Liquefied Petroleum Gas Code

NFPA 70, National Electrical Code

UL 1008, Transfer Switch Equipment

CSA B139, Installation Code for Oil Burning Equipment

CSA B140-0, General Requirements for Oil Burning Equipment

CSA C22.1, Canadian Electrical Code, Part 1

CSA C22.2 No.100, Motors and Generators

CSA C22.2 No. 182.3, Special Use Attachment Plugs, Receptacles, and Connectors

3 Definitions

3.1 alternator: A device for converting mechanical energy into electrical energy in the form of alternating current.

NOTE: The terms “generator” and “alternator” are used interchangeably in this standard.

3.2 electric utility: An enterprise engaged in the production and/or distribution and sale of electricity for use by the public.

3.3 engine-driven generator: An electric generator so constructed that its rotor is driven by an engine dedicated solely to the generator. This is also referred to as a generator set.

3.4 generator: A general name for a device that converts mechanical energy into electrical energy. The electrical energy may be direct current, DC, or alternating current, AC. An AC generator may be called an alternator.

3.5 PTO: Abbreviation used for power take-off.

3.6 standby power: The power to be delivered by a generator during periods when there is an outage of utility or prime power sources or when these sources provide power outside the acceptable limits of quality or capacity.

3.7 tractor-driven generator: An electric generator so constructed that its rotor is driven by the PTO of a farm tractor through a PTO speed changer and drive shaft.

3.8 transfer switch: An automatic or manual device for transferring one or more conductor connections from one power source to another.

3.9 weatherproof: Constructed or protected so that exposure to the weather will not interfere with successful operation of the equipment.

3.10 Additional terminology and definitions are included in EGSA 101G.

4 Installation

4.1 Delivery Inspection. The generator should be carefully inspected on delivery for evidence of possible damage. The damage should either be corrected or deemed to be inconsequential by the dealer before the generator is operated.

4.2 Review of Installation and Operator's Manual. The manufacturer's installation and operator's manual should be thoroughly reviewed before attempting to install the standby generating system, whether it is an engine-driven or a tractor-driven type.

4.3 Location

4.3.1 The generator should be located in an atmosphere that is free from excessive dust, snow, or other wind-blown particles, high and/or low temperatures, and corrosive fumes.

4.3.2 Allowance should be made for a minimum clearance of 0.9 m (3 ft) around the set for service accessibility.

4.4 Mounting

4.4.1 Permanently installed, engine-driven electric generators should be mounted on a concrete base in accordance with the manufacturer's instructions.

4.4.2 Vibration dampening pads should be placed between the skid, or mounting base, and the floor or concrete base to minimize the transfer of vibration to other equipment.

4.4.3 Tractor-driven generators are normally either stationary mounted or mobile mounted on a trailer or with a three-point hitch.

4.4.3.1 Stationary mounting should follow the manufacturer's recommendations of mounting on concrete pads.

4.4.3.2 In the event of mobile mounting, such as a trailer or a three-point hitch, the mounting should be of sufficient size and stability to withstand pulling over rough terrain and to withstand torque stresses experienced when full loads are applied to the generator through the power take-off driveline and input connection.

4.4.3.3 Alternators should be mounted on the trailer or three-point hitch such that power drive lines are in good alignment.

4.5 Safety Provisions. The power take-off and power take-off drive lines for PTO tractor-driven generators should conform to safety provisions of ASAE S318 and ASAE S207.

4.6 Ventilation for Engine-Driven Generators. It is imperative that the engine and generator have an adequate supply of air for combustion and cooling.

4.6.1 Ductwork should be used when necessary from the radiator to the outlet to prevent hot air recirculation.

4.6.2 There should be a flexible ductwork section at any connection to the generator.

4.6.3 The air inlet must be larger in size than the air outlet. The air inlet should be two times the size of the radiator frontal area or as recommended by the manufacturer.

4.7 Exhaust. When an engine-driven generator is installed inside a building or other enclosure, means shall be provided for exhausting the gases from the engine exhaust system out of the building or enclosure.

4.7.1 Where the exhaust pipe passes through a wall of combustible material, the wall shall be shielded by a metal thimble at least 305 mm (12 in.) larger in diameter than the exhaust pipe.

4.7.2 The end of the exhaust pipe should be equipped with a rain cap, and should be located a suitable distance away from the air inlet of the engine so that exhaust gases cannot be drawn back through the air inlet.

4.7.3 Connection between the exhaust pipe and the engine shall be flexible to prevent breakage.

4.7.4 Exhaust piping should be as short as possible with minimum bends and restrictions, and large enough to prevent back pressures higher than those recommended by the engine manufacturer.

4.7.5 A drain cock shall be installed at the lowest point in the exhaust piping system for draining any moisture accumulations as a result of condensation.

NOTE: Frequency of draining depends on time and extent of use.

4.8 Fuel. Engine-driven generator sets shall be provided with fuel lines and fuel equipment to comply with the following standards: In the USA, NFPA 30, NFPA 31, NFPA 54, and NFPA 58. For Canada, comply with CAN/CSA-B139, and CAN/CSA-B140.0. The fuel lines from the natural gas meter to the fuel inlet of the engine shall be sized and installed in accordance with ANSI Z83.1.

NOTE: Fueling shall be carried out only after the engine is switched off.

4.9 Electrical

4.9.1 Electrical wiring shall be in accordance with the recommendations of the manufacturers and comply with local regulations, (in the USA, NFPA 70); (in Canada the Canadian Electrical Code, Part 1) and other standards where applicable.

4.9.2 Electric generators on engine or tractor-driven units shall be grounded in accordance with Article 250, NFPA 70.

4.9.3 Automatic transfer switches or manual transfer switches shall be approved by an independent testing agency (i.e., UL 1008) and installed so the generator and the electric utility's power cannot be energized at the same time. Transfer switches shall be installed in accordance with Article 702, NFPA 70.

4.9.4 Safety Requirements for Electrical Connection. The installer, maintenance personnel and operators shall ensure that the electrical connections to the generator meet all the following requirements.

4.9.4.1 Compatibility of Plug and Generator. The plug and generator receptacle shall be of like configurations to ensure compatibility with each other during the mating operation. Both the plug and the generator receptacle shall have the same wiring order. The polarization shall be keyed or of such design that polarization will not be defeated by improper assembly during installation.

4.9.4.2 Exposed Contacts

4.9.4.2.1 Mating plug and connector shall not have exposed live contacts during engagement or withdrawal (In Canada, as required in, and tested in accordance with, CSA Standard C22.2 No. 182.3).

4.9.4.2.2 As an alternate to 4.9.4.2.1, mating connectors which have exposed live contacts after withdrawal of the plug shall have a cover which is:

- a) spring loaded for self-closing the live parts of the connector after the plug is removed,
- b) secured on the opposite end of the spring by means requiring a tool or key to remove the cover when the connector is not in use, and,
- c) a warning sign alerting the user about the live parts under the cover and to secure the cover with the tool or key after the plug is withdrawn.

4.9.4.3 Weatherproof. Both connector and plug shall be of weatherproof type (In Canada meeting the requirements of CSA Standard C22.2 No. 182.3), unless the generator is specifically marked for the use in

weatherproof area only. The connector shall be located in 3R rated enclosure (In Canada, as per Table 65 of the Canadian Electrical Code, Part 1), if the generator is not installed in weatherproof area.

4.9.4.4 Caution Mark. A plug, connector or receptacle marked to indicate that it is not suitable to interrupt current shall not be used to interrupt current to the stand-by electric power system.

4.9.4.5 Strain Relief. Extra-hard-usage service cord or portable power cable shall be used to connect a stand-by electric power system to the fixed wiring. An approved method of strain relief to prevent transmission of strain to the terminal connections shall be provided for all cords and portable power cables.

NOTE: In addition to requirements above, the installer shall ensure that the phases and the neutral of the generator power supply to the farm building are mated with the corresponding phases and the neutral of the farm building. A wiring diagram or label on the power supply at the farm shall be provided.

4.10 Shields and Guards

4.10.1 Provisions shall be made to minimize the possibility of personal contact with hot surfaces or rotating components by installing suitable shields and guards.

4.10.2 Guarding should conform to ANSI/ASAE S493.

5 PTO Generators — Initial Start-Up

5.1 The PTO generator owner's manual should be thoroughly read and followed.

5.2 Prior to operation the PTO speed changer shall be filled to the specified level with oil recommended by the manufacturer.

5.3 Electrical wiring should be checked for loose connections and for loose or missing cap screws, bolts and nuts.

5.4 Starting Tractor-Driven PTO Generators

5.4.1 If not so equipped, add a breaker of appropriate size. Set the load circuit breaker on the generator to "OFF."

5.4.2 Connect the PTO driveline, or PTO shaft, securely to the generator and the tractor. Install all safety shields. Position the PTO driveline as near to a straight line as possible, not to exceed a 10 degree angle.

5.4.3 Start tractor and adjust power take-off speed to 540 or 1000 rpm (depending on type) by advancing the tractor throttle, so the PTO generator is producing 60 Hz, as indicated on the frequency meter. If no frequency meter is available, adjust to proper voltage as indicated on the voltmeter.

5.4.4 Place power cable coming from the manual transfer switch in the correct power plugs or receptacle on the generator control panel.

5.4.5 Place transfer switch in the stand-by position.

5.4.6 All load circuit breakers at the service entrance shall be in the "OFF" position before putting the main load circuit breaker on the generator in the "ON" position.

5.4.7 Maintain frequency at 60 Hz by adjusting tractor speed. If frequency meter is not available, the PTO speed shall be adjusted such that the voltmeter is maintained at the correct voltage as the individual load circuit breakers at the service entrance are turned on, beginning with the circuit breaker that controls the largest motor and then large to small motors.