



Standby Electricity Generation for Farms

INTRODUCTION

Mains electricity supplies are generally reliable for 98-99% of the time and so power cuts are rare occurrences. They are usually related to freak weather conditions, accidents or system failures which cannot be predicted. Occasionally, and with prior notice, power is disconnected for planned maintenance work on the electricity network.

Where livestock, stored produce or production lines rely on an electricity supply to sustain them, standby generation should be considered. For intensive livestock units the provision of a mains failure alarm system and emergency ventilation arrangements are mandatory under the Welfare of Livestock Regulations, 1990 (Reg.4). Specialist advice may need to be taken to ensure conformance with these regulations. It may involve the provision of an emergency electricity supply through a standby generator.

STANDBY GENERATOR INSTALLATION

The detailed installation and electrical connection of a standby generator is not a job for general farm staff. Fitting a generator and the accompanying electrical work must only be undertaken by a qualified electrician, experienced in this type of work, who is a registered installation contractor.

GENERATOR TYPES

There are two main types:

1. Tractor PTO driven either:
 - Static - bolted down to a concrete base and permanently wired, or
 - Portable - mounted on the three-point linkage of a tractor and with socket/plug connections.
2. Engine driven.

PERMANENT INSTALLATION

The generator should be installed in a clean dry building which is well ventilated and near to the incoming electrical supply. No farmyard rubbish such as straw or paper should be able to enter the building as this could be drawn into the generator cooling system causing it to overheat. When installing such equipment working space around the generator should be taken into consideration. Sufficient space outside the building should be provided for the correct positioning of the tractor to be coupled to the generator.

MOUNTING

When the generator is operated the tractor drive torque is transmitted to the generator floor fixings. The generator should be bolted down securely and the base to which it is fixed should be of sufficient strength. It is emphasised that extreme care should be taken here. Under no circumstances should the generator be bolted down to a poorly constructed floor or any other mounting arrangements employed. Generators can be bolted directly to an existing concrete floor provided that:

- The slab is level and minimum 100mm thick.
- The concrete is known to be 4:2:1 mix or better with no cracks and has not deteriorated.



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CHANGEOVER SWITCH

A changeover switch has to be installed to be able to switch from mains to generator supply. The current rating and number of poles in the switch must be compatible with the installation and the earthing system in use (contact your electricity supplier for their requirements). It should be remembered that the changeover switch normally carries the full current of the incoming mains supply and should be sized accordingly.

PORTABLE PTO GENERATORS

PTO generators are available in a mobile form i.e. the generator is fixed in a frame mounted on the three point linkage of a tractor. The electrical output of the generator is transmitted by a flexible cable and socket/plug connection.

For safety reasons it is essential that the socket outlet (female) of the connection is fitted to the output cable of the generator. A wall mounted male appliance plug, via a changeover switch (as with a permanent installation), connects the generator to the electrical system.

When not in use portable generators should be stored under cover in dry, well ventilated conditions.

Positioning and Connecting the Tractor

This should be carried out as instructed in the manufacturer's operating manual. In general the tractor should be positioned on a level surface of concrete or hard-core. The height of the tractor PTO shaft should be the same as that of the generator shaft +/- 50mm.

Once positioned and connected it is extremely important that the tractor cannot move. Wheel stops that help with tractor positioning are useful here.

Tractor Power Requirements

kVA	PTO Horse Power	
	1-phase	3-phase
10	14	13
15	20	19
20	26	25
25	33	31
32	42	40
40	52	50
50	-	62
70	-	86

Tractor PTO Speed

PTO generators are normally fitted with a device to indicate when the correct tractor PTO rpm has been attained to produce power at the standard mains frequency 50Hz.

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ENGINE DRIVEN GENERATORS

Engine driven generators are usually supplied as 'skid-mounted', self-contained units complete with control panels. As with a PTO generator, installation of a changeover switch is required. However, engine driven generators have the advantage over PTO installations in that the changeover operation can be automated if desired.

Several factors have to be considered when planning an engine driven generator namely:

1. Housing, access and maintenance.
2. Floor loading / vibration mountings.
3. Ventilation to generator room and engine cooling.
4. Engine exhaust and emissions.
5. Noise reduction.
6. Size and location of fuel tank.
7. Frost protection of engine.
8. Cable sizing and electrical installation.

HOUSING, ACCESS AND MAINTENANCE

The generator housing should be weatherproof and large enough to allow access for maintenance. Remember that from time to time major overhauls will be necessary with the removal of part or all units. Provision should be made for this in the design of the housing and the route to it.

FLOOR LOADING AND VIBRATION MOUNTINGS

As with PTO generator requirements the unit may be bolted direct to the floor if the concrete is sound enough or a purpose built concrete plinth can be constructed.

Smaller generator units usually have rubber vibration isolation pads and springs fitted between the generator and the unit base frame. Larger units are more likely to be bolted direct to the base frame. The vibration isolation pads and springs are then fitted between the base frame and the floor.

Other attachments to the generator unit such as fuel lines, exhaust system, radiator air discharge and conduit for control and power cables should all be provided with flexible connections to prevent vibration damage.

VENTILATION

The engine and the generator both give off heat when operating thus raising the temperature of the plant room air. To operate correctly cool clean air should be drawn into the room, passed over the unit and discharged via the engine radiator. The ambient temperature in the room should not exceed 30°C. Air flowing this way through the plant room will produce steady operating conditions. For vent sizes and cooling air volumes consult the manufacturers' technical information.

ENGINE EXHAUST AND EMISSIONS

Engine exhaust must be piped directly outside via a property designed exhaust system. The system must ensure there is no dangerous build up of fumes elsewhere or recirculation back into

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the plant room.

Where the exhaust pipe passes through the plant room wall it must be in a sleeve to absorb vibration and an expansion joint should be fitted. As the exhaust pipe will be hot it should be situated away from any combustible material and shielded to protect personnel.

NOISE REDUCTION

Using resilient mounts for the generator, with correct sizing of air intake and discharge to the plant room together with a silencer, usually produces an acceptable noise level. However, where noise levels have to be reduced further i.e. near a residential area, then the use of an insulated silencer possibly mounted within the plant room itself can often solve this problem.

SIZE AND LOCATION OF FUEL TANK

Most engine driven standby generators are diesel powered. The diesel tank for the unit should be situated as close as possible to the engine (often in the same room or adjacent to it). Remember if the diesel tank is placed outside and subjected to cold conditions then the correct grade of fuel (winter grade) should be specified and stored.

The tank should have easy access for refilling, cleaning out and inspection. Attention should be given to the level of the tank in relation to the engine fuel pump. In certain circumstances a positive head of fuel is not desirable. Consult the manufacturer's technical information for details.

Galvanised tanks must not be used to store diesel due to chemical reaction between the fuel oil and the galvanised coating.

Storage tank capacity is based on the anticipated fuel consumption and the number of hours of operation between refills. Sizing the tank is particularly important for standby generators as a mains electricity outage may also hamper your local fuel supplier's operation.

Most fuels deteriorate if they stand unused for long periods. For standby generators it is best to store only enough fuel for a few days running. A guide is that normal engine testing should consume a tank-full within 18 months.

N.B. The Control of Pollution (Silage, Slurry & Agricultural Fuel Oil) Regulations, 1991 cover storing more than 1500 litres (330 gallons) of agricultural fuel on farms.

FROST PROTECTION OF ENGINE

Remember that the engine cooling system should be protected with antifreeze which should be periodically checked and renewed when necessary.

CABLE SIZING AND ELECTRICAL INSTALLATION

Any electrical work and calculation of cable sizes etc., should be left to a competent electrical contractor familiar with such work.

PEAK LOPPING

Farm businesses with sizeable standby generation facilities should review their potential for

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'peak lopping' i.e. the operation of the generator to lower the total demand for power from the mains. This can have financial benefits in reducing maximum demand and saving high cost electricity units. In certain cases the electricity company may be willing to purchase exports of power at times of peak demand. Specialist companies exist that can convert standby plant to peak lopping operation. If power is to be fed to the mains network an export agreement with the electricity distributor along with metering and controls that conform to Electricity Engineering Recommendation G.59/1 will be required. Such use of customers' plant is known as 'embedded generation'.

To estimate fuel consumption a rule of thumb to use is: multiply the kW rating of the generator by 0.27 to give the hourly consumption in litres.

GENERAL NOTES

Sizing

Choice of generator size will depend on what is deemed to be essential equipment in an emergency situation. In some cases the generator will be required to deliver enough electricity to service the whole site. In other cases, basic equipment like lighting and cooling might only be covered. A record of the circuits which the generator is rated to service should be kept near the changeover switch as a reminder.

(Note: For generators which start-up automatically, the unit should be rated to cope with the whole electrical requirement of the site).

In sizing the generator, the kW ratings of the required operational equipment should be added together and a safety margin added to arrive at the total rating. Take special heed of large electric motors which may require a high power input when starting. As a rule of thumb, the generator capacity should be no less than 2V2 times the rating of the largest single electric motor.

Starting Procedure

In the event of a power failure an automatic system should cut-in within a few seconds. For manual start systems, the necessary manual switch over should be carried out first, before starting the generator. All circuits should be switched off prior to starting and gradually brought on after the generator has reached full speed. The current drawn from the generator can be monitored on the generator ammeter.

Testing

All generators should be run for a few hours on a bi-monthly basis or at manufacturers' recommended intervals to check reliable operation.

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