Munich RE

Maintaining Emergency and Standby Engine-Generator Sets

Risk Solutions

Hartford Steam Boiler
One State Street
P.O. Box 5024
Hartford, CT 06102-5024
Tel: (800) 472-1866
www.hsb.com

June 2014

Scope

This recommended practice applies to emergency and standby power systems from several hundred kilowatts (kW) to several megawatts (MW), provided the individual engine-generator sets are no larger than 2 MW net power output each. Level-1 and Level-2 generators, as defined by the National Fire Protection Association NFPA are covered. This recommended practice applies to both portable and stationary units connected to the building's electrical system through a manual transfer switch or an Automatic Transfer Switch (ATS). Standby or peak shaving power systems that are capable of synchronizing with the power grid are beyond the scope of this paper.

Introduction

Engine-generator sets provide limited power in the event of a power outage. They consist of an engine, a generator, control panels, and possibly a fuel storage tank. The engine drives the generator to create electrical power.

NFPA defines two classes of electric generators: Level-1 generators provide support for life safety systems, such as emergency lighting, fire protection and ventilation to provide for safe egress in the event of an emergency; Level-2 generators encompass all other uses such as backup power for data centers, auxiliary systems, process controls, refrigeration, and HVAC systems. For the purposes of this recommended practice, Level-1 generators are referred to as emergency generators and Level-2 generators as standby generators.

Emergency generators are typically 200 kW or smaller and run on gasoline, natural gas or #2 diesel fuel. Standby generators are typically much larger diesel engine units, often between 200 kW and 2,000 kW (2 MW). The use of natural gas for the larger units is often limited by the size of the available gas supply line. For example, a 150 kW natural gas fired unit normally requires at least a 3 inch diameter supply line. However, natural gas can be advantageous in smaller systems due to availability, reduced maintenance costs and reliability.

Emergency and standby generators are usually stationary units permanently wired into the building's electrical distribution system through a transfer switch. The ATS is the most common type of transfer switch used for these applications.

1866
Hartford Steam Boiler

An ATS provides a control signal enabling the generator to start and then transfer the electric load from the main power supply to the generator.

Improper or poorly maintained generator sets are more prone to failure and are more likely to fail when needed most. The most common engine failures can be attributed to the starting, cooling, lubrication, or fuel delivery systems. Failure of the electric generator is often attributed to excessive moisture in the generator windings. These types of failures can be minimized or prevented, by implementing regularly scheduled, comprehensive generator maintenance and testing programs. Some units may have heaters to help keep condensation moisture from developing.

Depending on your location, it may be possible to contract with a local service provider or equipment dealer to provide or develop a preventive maintenance plan. In-house maintenance and testing should only be performed by qualified technicians. Either way, implementing a regular maintenance program is important for ensuring that your emergency generator works when you need it. A sample check sheet is included at the end of this document.

Program overview

A good maintenance program can be compared to routine maintenance of a car: checking fluid levels, changing lubrication oil, coolant and fuel, and testing the starting system, including the batteries. Regularly running the engine-generator will keep it working at optimum performance levels. Spare air, oil, and fuel filters should be also kept on hand in case one is needed in short notice.

Extreme temperatures, salt water, or excessive exposure to debris, such as dust or sand, may require more frequent inspections. Take this into account while planning a maintenance program. Also, ask the manufacturer or the service provider for recommendations when housing a generator in an area with these conditions.

Keeping a maintenance log is also important. A record of all maintenance, inspections, fluid levels, and test results will enable more accurate planning of future maintenance. Well-kept logs may also be important for warranty and insurance purposes.

These practices are meant to complement the Original Equipment Manufacturer (OEM) maintenance procedures. A maintenance program should be based on the OEM-recommended maintenance.

Visual inspection

The area surrounding engine-generator should be kept free of debris and provide sufficient ventilation during operation. When the generator is not running, conduct weekly inspections of the surrounding area to ensure fluids, such as oil and coolant, are not leaking. Inspect the exhaust system, including the manifold, muffler, and exhaust pipe. All connecting gaskets, joints, and welds should also be checked for potential leaks. Clean the starting and electrical system terminals. Connections should be tight and free of corrosion. Any adverse conditions should be corrected promptly by a qualified technician.

Cooling system

Periodically check the coolant level. The cooling fluid mix is a balanced solution and varies from manufacturer to manufacturer. Don't mix your own. Make sure the solution you use is approved for use in your engine. Clean the radiator to remove any dust and/or debris, taking care not to damage the fins. Make sure the coolant heater is operating correctly by monitoring the discharge temperature.

Fuel system

Visually inspect the fuel delivery system periodically for leaks and correct pressure while running the engine. Check fittings and connections; tighten them as needed. Drain and clean fuel filters as recommended by OEM. Examine charge-air piping, and supply hoses for leaks, holes, and damaged seals. The fuel system and charge-air cooler should also be free of dirt and debris.

Fuel maintenance is another important aspect of generator maintenance. Gasoline and diesel fuel degrade over time. A process of separation and stratification, even growing micro-organisms, can occur in fuels. The fuel tank should be equipped with a plug or valve which allows accumulated water to be drained from the tank periodically. A fuel sample, taken from the bottom and from the supply line, should be visually examined monthly. The fuel should look like new fuel; otherwise it should be filtered or replaced.

Fuel tanks should be sized so that the fuel is used and turned over on a regular basis. Fuel should be turned over or replaced on an annual basis. A proper fuel maintenance program is important.

Please refer to HSB's Recommended Practice for a Diesel Fuel Maintenance Program for more information.

Batteries and wiring

Batteries should be inspected to make sure they are fully charged. The batteries must be tested under load. Simply checking the voltage is an inaccurate method of testing for a battery's power. Battery cables and terminals should be kept clean and free of corrosion. Where appropriate, check the specific gravity and electrolyte levels. All engine wiring should have tight connections and be free of corrosion or damage. Check with your generator manufacturer for their recommended battery and wiring practices, cleaning agents and methods.

Exercise

Start and run the engine-generator monthly. Operate the engine until its temperature has been stable for at least 10 minutes. That's when engine parts become lubricated, oxidation is prevented, old fuel is consumed, and overall functionality is verified. Operate the generator annually for a minimum of 1 hour at 100% of the generator nameplate capacity. When testing a stationary unit, testing should be done through the ATS to ensure that the entire electrical system is working properly. If it is not possible or practical to use a site load for the test, a load bank should be used. Sometimes problems only become noticeable during operation. Therefore it is important operators remain alert for unusual circumstances such as abnormal sights, sounds, vibration, excessive smoke, or changes in fuel consumption. Remember to check for leaks, loose connections or components, and abnormal operating conditions. Correct these as necessary.

These recommendations are intended to supplement the equipment manufacturers' recommendations - not replace them. Always consult with your manufacturer before implementing any new service program. The standard of workmanship and procedures for all inspections and overhaul repair work should comply with the manufacturer's specifications. It is the sole responsibility of the owner/ operator of the equipment to perform any and all duties and tasks associated with their selection, installation, operation, inspection, maintenance, repair and other issues connected with their equipment.

HSB Recommended Best Practices –Maintenance Checklist

Weekly Procedures	Repairs (as necessary)	Pass/Fail	Inspection Date
Visual inspection of unit – leaks, wear, damage, loose connections/components, corrosion	Correct		
Check engine oil level	Adjust		
Check engine coolant level	Adjust		
Check fuel delivery system – leaks, pressure	Tighten connections		
Check air inlets/outlets for debris	Clean		
Check battery charger – verify voltage and operation	Adjust		
Return the unit to standby setup for operation	When required		

Monthly Procedures	Repairs (as necessary)	Pass/Fail	Inspection Date
Check engine coolant thermal protection level	Correct		
Check gearbox oil level (if equipped)	Adjust		
Check battery electrolyte level and specific gravity (where appropriate)	Adjust		
Check battery posts, cables, and charger –connections, corrosion, proper operation, battery load test	Correct		
Check wiring – connections, corrosion, damage	Correct		
Check engine drive belts, fan coupling device – tension, wear, weather cracking, damage	Correct		
Automatic start and run the engine for at least for at least 10 minutes or until the engine temperature has stabilized. Check for leaks, connections, components, abnormal operating conditions	Correct		

Annual Procedures	Repairs (as necessary)	Pass/Fail	Inspection Date
Engine oil and filters	Change and replace		
Gearbox Oil (if applicable)	Change		
Drive belts, fan coupling device for tension, wear, weather cracking, damage	Replace		
Clean and re-cap spark plugs (if equipped)	Replace		
Engine air filters	Replace		
Automatic start and transfer to a load bank (or site load). Exercise it for at least 1 hour at 100% of the nameplate capacity. Check for leaks, connections, components, abnormal operating conditions	Correct		