Genset Installation and Maintenance

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The growing trend toward onboard refrigeration, and the appearance of more creature comforts in the cabin and wheelhouse, have contributed to a surge in demand for AC power generation. Manufacturers are happy to oblige with lines of compact and efficient gensets.

Buyers have a choice of designs, including the hydraulic- or belt-driven "cruise" generator that runs off the main engine, and the more common modular genset powered by an auxiliary diesel engine. This article addresses only the latter. Within this category, choices include different speed units, including 1,200, 1,800, and 3,600 rpm sets, plus variable speed technology (VST). There are single phase and three phase. You've got transformer regulated generators that are good at running big electric motors, and externally regulated generators that deliver a constant voltage. There is keel cooled and heat exchanger cooled, wet exhaust and dry. Some of the familiar brands, like MER and Northern Lights, are "packagers" that buy engines from one or more builders, and marry them to generators from other companies, and include peripherals like mounting bases, cooling systems, and controls. When ordering a set you should be able to pick and choose to get the brand and specific characteristics you want.

Selection

Selecting the correct genset is the first step toward getting maximum efficiency and longevity. Overloading will kill a unit quickly; underloading will kill it more slowly but just as surely. Best efficiency and longevity are at about 70% of maximum load, and a diesel generator runs at less than 25% load.

Proper sizing is important, and various books and articles can help you calculate the best size for your needs. Ultimately, however, you should provide the details of your demand profile to the dealers so they can do a load analysis and help you make the best choice.

Installation

Proper installation is the second step. Like all diesels the genset needs clean fuel, adequate coolant, and sufficient fresh air to run the engine. It also needs fresh air to cool the generator itself. The conversion of rotating mechanical energy to electricity produces heat, and an overheated generator (actually, in most cases, a large alternator) is inefficient and short-lived.

Gensets tend to be an afterthought in vessel design, and because modern units are so compact, they tend to get crammed back in a corner with inadequate ventilation, lack of access for maintenance, and insufficient space for safe and effective exhaust systems. I once had an old Kohler that was shoehorned in so tight to a bulkhead that I had to use a dentist's mirror to find the bleeder nuts on the Perkins engine's injection pump.

Mechanics see all sorts of odd-ball installations: genset engines starved for fuel because their supply is teed off the main engine line and the main's lift pump is stronger; auxiliaries and mains on the same integrated keel cooler, which doesn't allow both to be run at the same time without overheating.

Here are some installation tips:

- Place the unit where it is well ventilated but safe from moisture and spray. Windings inside the case are coated with epoxy or other insulation designed to keep moisture out, but salt crystals erode the coating and eventually moisture works its way in, corroding the windings. If wet exhaust is used, try to route the exhaust hose away from the generator so that if any leaking occurs it won't destroy expensive winding, brushes, or bearings.

- Likewise, avoid oils and oily air. Blow-by from other engines in the compartment clings to the windings, creating an additional layer of insulation. This leads to overheating and could cause a fire.

- Position the unit so the service side is easy to reach, and there is adequate overhead space to fill the expansion tank, remove the valve cover, and work around the rear end bracket on the generator.

- Use rings or grommets on the wire ends in the junction box.

- Install a pump to facilitate oil changes. On some units the lip of the oil catch pan is too high to allow effective oil drain by gravity alone.

- Use circuit breakers.

- Use a good bonding system.

- Put the unit on its own fuel, cooling, and exhaust systems. Use a separate starting battery rather than wiring it into the main's starting bank.

- Bolt the base frame to a thick, rigid material like a board or piece of plywood, to reduce sound transmission.

- Although it may contribute to electrolytic corrosion in the heat exchanger and other parts, the AC neutral conductor should be grounded to the bonding system. To not do so creates the possibility of dangerous electrical shock. However, certain classification societies prohibit grounding, so if your boat is built to classification standards, check with the society to ensure compliance.

Wet exhausts

In recreational and passenger vessels, and in fishboats retrofitted with gensets, heat exchanger/wet exhaust systems are com-

mon. They are quiet, relatively simple to install, and minimize fire hazard. However, they pose special installation problems. Between the water lift muffler and exhaust outlet the hose must contain a loop with a high point at least a foot higher than the through-hull. (Ideally, the through-hull should be another foot above the load water line. This can be a problem in a vessel whose load line changes markedly as fish are taken on board.) Furthermore, if the point of water injection into the exhaust (at the outlet of the exhaust manifold) is less than a foot above the waterline, there must be a vented loop in the hose between the raw water pump and the heat exchanger. This is to prevent back siphon, which could destroy the engine or even sink the boat.

Tips for heat exchanger/wet exhaust set-ups:

- Use only the flat-type seawater inlet through-hull. The scoop type could cause seawater to flood the engine when the boat is underway and the genset is not running. (I was surprised to learn this since my boat has a scoop inlet and it has operated for years with the auxiliary on or off without harm. I think it is a function of how fast the boat travels, and mine makes only displacement speeds. This boat also has a teed fuel system, but the main is relatively easy on fuel which may explain why I haven't had problems.)

- Use a good marine ball valve immediately above the seawater inlet, and a sea strainer between it and the raw water pump. A clear barrel makes it easy to check for debris, and it has to be located where it can be opened and cleaned.

- Allow no "belly" or low spot in the exhaust hose that can trap water. This trapped water can flow back into the engine when the boat takes a hard roll, and it creates back pressure in the exhaust system. A sure sign is water surging from the exhaust outlet rather than spraying evenly. Maintain a downward slope of at least one-half inch per foot from the top of the exhaust hose loop to the outlet.

- Maximum height between the water lift muffler and the top of the exhaust loop can be no more than four feet. If the genset is situated lower in the hull than that, a special exhaust system has to be made.

- Don't allow the engine to crank more than one minute without starting. Accumulated cooling water in the muffler can back up and flood the engine. If you have to crank longer, such as to bleed the injectors, close the seacock and remove the raw water impeller first.

Maintenance

"Plug and play" is a popular concept in technology these days. An efficient generator married to a compact diesel engine can be dropped into place, bolted down, and plumbed to cooling and exhaust, fuel, and return in just a few hours. Plug in a single socket and you have the AC circuitry, battery charging, voltage regulation, system monitoring, and controls all connected instantaneously.

The problem with plug and play gensets, say the folks who sell and repair them, is that they are so convenient, so reliable, that some operators plug them in, turn them on, and pretty much forget about them. No matter how well engineered, a complex piece of machinery operating long hours in a damp and dirty engine room is going to need a little attention.

Read the owner's manual and follow instructions. Not all of it is intuitive. Maintenance on the little auxiliaries may differ from other engines.

Maintenance schedules vary from one manufacturer to another, but a typical one calls for checking engine oil and coolant levels daily; checking valve clearance after the first 50 hours and every 600 hours thereafter; changing engine oil and filter, and secondary fuel filter, every 200 hours; checking and flushing the cooling system and changing the raw water pump impeller every 600 hours; and cleaning the heat exchanger every 2,400 hours.

One of the few repair jobs that the average user can do is replacement of generator rear-end bearings. They are in a sealed housing and can't be lubricated, but the end plate can be removed and the bearings extracted with a bearing puller, available at auto supply houses. At about 5,000 hours bearing wear becomes something to check for.

Otherwise, unless you are a trained electrician there isn't a lot of repair you can do as the operator. If you can read a wiring diagram, you can consult texts, such as *Boatowner's Mechanical and Electrical Manual*, by Nigel Calder, for instructions on diagnosing generator output problems. But remember, **120-volt AC can kill you. Do not attempt any diagnostics or repair on an operating generator unless you know what you are doing.** Even when not in operation, capacitors on some units can deliver a fatal charge.

Follow the instructions in the manual, and your small genset should crank out a steady 120 volts at 60 Hz for around 8,000 to 10,000 hours. Bigger sets with industrial diesels, especially the 1200 rpm units, can be good for tens of thousands hours. ✥