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The Essential Spare P



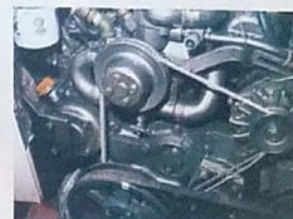
STORY AND PHOTOGRAPHY
BY STEVE C. D'ANTONIO

In Part 1 of this two-part series, we'll look at spare parts philosophy and determine what the well-equipped trawler should carry in the way of spares for the engine and its related systems.

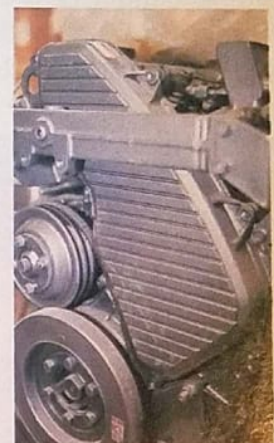
YOU'RE ON YOUR OWN

Several years ago, while southbound on the Chesapeake Bay, traveling from St. Michael's back to the boatyard, I had a first-hand encounter with the spare parts gremlin.

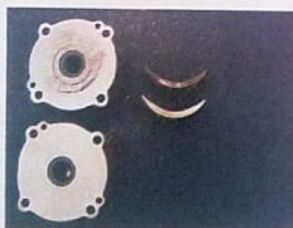
The weather was superb, the sun shining, winds light, temperature pleasant and all was right with the world. Sometime shortly after noon on the first day,



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Locker For Trawler Cruisers – Part 1



however, that delusion came to a crashing halt. Immediately after my wife, Sandy, handed me a tuna fish sandwich, I heard a metallic clang, followed by a rhythmic thump. I instinctively scanned the engine instruments and noticed that the tachometer's needle rested limply against its stop pin. The voltmeter also hovered alarmingly at somewhere between 11 and 12 volts. Assessing these clues in my gear-head

consciousness, I quickly arrived at the conclusion that the engine had thrown a belt.

I shut the engine down and proceeded toward the holy place, to kneel before the cast iron propulsion goddess and beg forgiveness. I was guilty of two of the most amateurish and cardinal sins in the world of the sea: complacency and failure to prepare. Not only had I neglected to check the belts before setting

I was guilty of two of the most amateurish and cardinal sins in the world of the sea: complacency and failure to prepare.

out on a 150-mile passage, I had also failed to lay in the proper complement of spares.

Upon inspection I confirmed that the belt that drives the alternator and cooling system circulator pump lay in shreds at the bottom of the engine compartment. Several frustrating hours and a number of bloody knuckles later, we were ticking along at reduced power. With a MacGyverian reputation to protect, I managed to fashion a V-belt out of a length of nylon flag halyard, some electrical tape and a few plastic wire ties.

Because the vessel possessed ample battery capacity, I opted to skip driving the alternator, lassoing the circulator pump to the crankshaft pulley alone. This minimized the strain on my fragile mechanical arrangement, of which Rube Goldberg himself would have been proud. Other than a staccato clackety-click caused by the wire ties passing over the pulleys, the flag halyard pseudo-belt performed admirably until we could make port. The propulsion goddess had been appeased, for the moment.

This episode taught me a valuable lesson about the necessity of properly stocking the spare parts bin. Because the vessel was not my own, it did not occur to me to make these all-too-necessary preparations, an inexcusable error at best.

In the years that I have been in the marine industry, making many passages, both inshore and offshore, the necessity and importance of properly kitting out the spares locker has been reinforced. Because I am frequently making passages aboard other people's vessels, this is often difficult. In addition to fashioning fan belts from twine, I have been forced on occasion to repack stuffing boxes with T-shirts carefully cut into strips and then rolled and slathered with Crisco, splice broken steering cables with C-clamps, and make water pump gaskets from nautical charts. Mechanical creativity goes hand in hand with cruising. However, nearly all of the above-

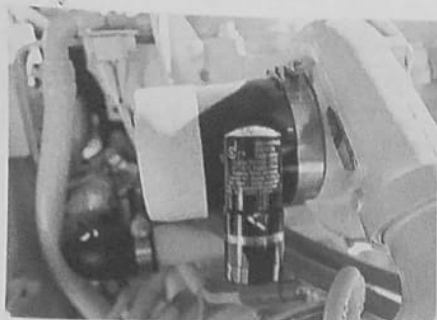
mentioned scenarios could have been easily avoided had proper spares been placed aboard these vessels.

SPARES PHILOSOPHY 101

Carry the necessary spares—a detailed discussion of which follows—even if you are woefully ignorant of all things mechanical. In the event of a failure, half the battle is having the right parts. You can frequently find someone to install them. It's not uncommon for well-prepared cruisers to limp into my boatyard with, for example, badly fouled injectors. Once the problem is diagnosed, they hand me the spare set they've kept aboard for the last five years, I install them and they are under way in less than a day. The alternative is to either rebuild the original set, which, depending upon the fuel shop's backlog, could take a week, or order new units. The latter option presumes they are available somewhere in the country (not always the case for obscure or older engines) and that they can be shipped with some haste.

I like to hang around boatyards and, at the risk of sounding immodest, mine is a particularly nice one to hang around. You, however, have a trawler so you can enjoy cruising, not so you can sit dockside listening to the melodic tones of grinders and travel lifts as they waft into your cabin at 7 in the morning while you anxiously await the arrival of the UPS truck and your spare parts.

The next spare parts philosophical crossroads you will encounter involves a question of quantity. How many spare parts are enough? Naturally, this can be taken to extremes, as in the flag halyard fan belt—an obvious example of not enough spares—or, at the opposite end of the spectrum, the spare or wing engine found on some "single" screw trawlers. In order to answer this question, you must first determine what type of cruising you intend to do. On a recent passage I made from Chesapeake Bay to Bermuda (see *PMM* Dec. '02) aboard a single screw trawler, it was obvious that I could expect assistance



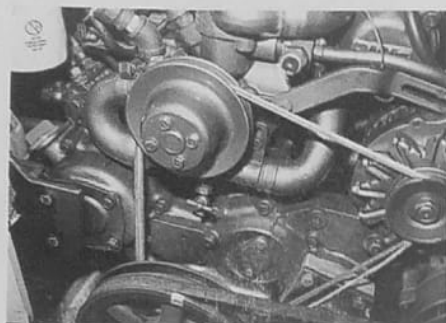
An air filter condition indicator, much like a fuel vacuum gauge, will alert you to a clogged air filter. When resistance in the air filter element exceeds a certain limit, the indicator moves from "GREEN" to "REPLACE" condition.



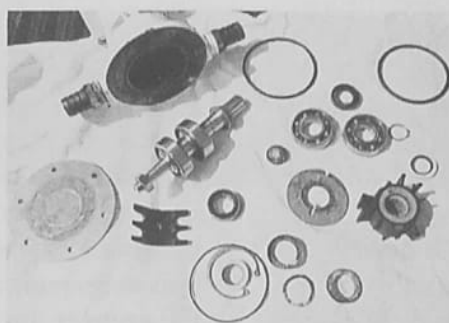
Not all zinc anodes are this well labeled; they are often difficult to find. Don't, however, let this or your lack of spares deter you from regular inspection and replacement.



Labeling spin-on oil and fuel filters with date and engine hours of last replacement will serve as a service reminder. This practice will also aid you in determining if and how many replacement elements you will need during a cruise.



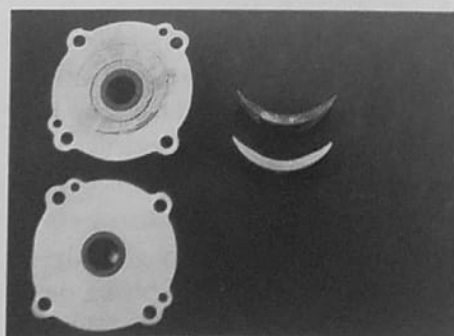
Creativity is a valuable character trait where on-site engine repairs are concerned. This flag halyard fan belt, however, would have been unnecessary had the author carried a spare.



The guts of the average gear-driven raw-water pump. These seemingly simple devices contain a plethora of components. If you are uncomfortable disassembling and reassembling this profusion of parts, you might be better off replacing the pump en masse.



A complete replacement water pump. It's simple: Unbolt the old one, bolt on the new one and you are ready to go. Some engines require removal of other components to access the pump, so assess your situation before counting on this quick fix.



Old raw-water pump cover plate and cam shown at top, spares on the bottom. Notice the degree of wear on the old units. This is sometimes not evident until they are compared to the spare parts. This pump had weak water flow; in comparing the parts it's easy to see why.



Starts are costly, but rebuilt units like this one are often available at considerable savings. Be prepared to pay a core charge, since you will not be turning an old unit in at the time of purchase. To store, this unit should be sprayed with a corrosion inhibitor, bagged and then replaced in its cushioned box.



Even if you opt not to carry enough oil to do a change on both 18-quart engines and both 4-quart gensets, at least carry enough for making up oil loss in the event of a major leak.

from no one other than my own crew. Thus, having been previously initiated into the "not-enough-spare-parts" club, the spares locker for this voyage erred on the heavy side. In spite of this, even this kit weighed in at less than 200 pounds, and it included some bulky items such as a starter, alternator, circulator pump, injectors and injection pump as well as several spare V-belts, genuine water pump gaskets and stuffing box packing.

For an inshore passage I would never dream of carrying such a sophisticated spare parts package, unless I were to cruise desolate coastlines such as those found in South or Central America or in other less developed locales.

An important part of the spares equation also relies heavily on the age and state of maintenance of your vessel. How old is the boat or, more importantly, how old are the systems and have they been properly installed and maintained? New boats that have poorly installed systems are often less reliable than older boats whose systems are well installed and regularly serviced. How will you know into which category you fall? Ask a trusted boatyard or qualified surveyor to inspect the boat to answer just this question. I suspect, however, that unless your boat is new, you already know the answer to this question. If you have repeated failures of the same gear or something different fails every time you get under way, your vessel probably falls into the "less than reliable" category, and thus you have the choice of either correcting the defects or enlarging your spares locker.

The final component in the spares philosophy involves the decision to carry either rebuild and repair components or complete spare subassemblies. For example, installing a complete raw-water pump is often less troublesome and time consuming than replacing the impeller, cam, seals and cover plate. Many cruisers who opt for the subassembly route often carry rebuild kits, as well. With this approach, the removed, malfunctioning spare part can be rebuilt at leisure after reaching an anchorage or port. The repair versus rebuild decision will also be influenced by your own mechanical abilities. Some folks simply are not comfortable rebuilding an electric head assembly; they'd rather just replace it.

Before delving into the details of spare parts recommendations, it's worth noting that in order to effect repairs using most of these parts, you must possess a proper tool kit. My thoughts on this subject can be found in "The Cruiser's Tool Chest," *PMM* Aug. '01.

As far as I'm concerned, spare parts fall into two categories: parts for the engine and everything else. After watertight integrity, propulsion is what it's all about; most other items are secondary in importance to a properly running engine and spinning propeller.

ENGINE-FUEL SYSTEM

No cruising trawler skipper should even consider leaving the dock without at least one, and preferably several, fuel filters aboard. These include primary (the filter between the tank and the fuel pump, often a Racor MA series) and secondary (this filter is often found on the engine and is usually of the spin-on variety for newer engines and the sandwich canister type for more mature power plants). Spin-on secondary filters will often require the aid of a filter strap wrench for removal. Make sure your tool kit contains one of these wrenches. You'll need one for your oil filter, as well. If you're fortunate, the filters will be similar in diameter, which will mean carrying one wrench instead of two.

Don't forget any other filters found within your particular fuel system, such as those found within electric and mechanical fuel lift pumps. I have seen occasions where these filters have become hopelessly bound up with asphalt or biological masses, while the primary and secondary filters, having been regularly replaced, are clear. This condition will restrict the flow of fuel to your engine, possibly to the point of criticality, leading to engine shut down. Additionally, because these filters typically possess precious little surface media, they are easily overwhelmed with contamination. A final word on these diminutive filters: They are often difficult to obtain from sources other than the engine manufacturer or a dealer, unlike primary elements and spin-on or even sandwich-type secondary filters, which can often be had from the local auto parts store.

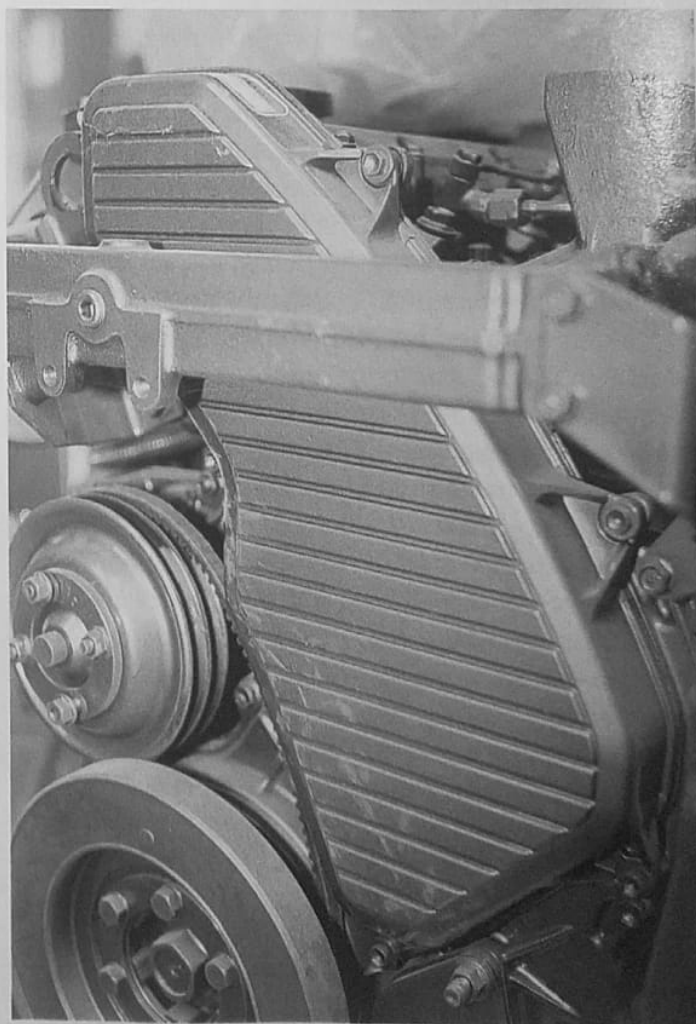
It comes as a surprise to many cruisers to learn that most primary fuel filter assemblies are "rebuildable." Rebuild kits are available for most primary filter bodies, particularly the more complex sight glass and coalescer equipped units. Service or seal kits usually include just the basics, essentially O-rings and gaskets. If you want to enhance this kit, assemble your own complete rebuild package. Just what this kit includes will vary from manufacturer to manufacturer; however, it should at least include a replacement sight bowl (make sure you obtain the clear marine version rather than the amber tinted automotive component), check ball and seal.



Above: A few essential engine spares. Top row, left to right: spin-on fuel filter, internal electric fuel pump filter, cartridge-type secondary fuel filter, heat exchanger end cap gasket, electric fuel pump and raw-water pump cover plate. Second row: serpentine belt (if you're fortunate, this may be your only belt). Third row: emergency stop lanyard for your dinghy outboard (lose this and the outboard is useless), raw-water pump impeller. Fourth row: V-belt, probably one of at least two and possibly more all of different sizes, if your engine doesn't utilize a serpentine belt.

Right: Like many automobile engines, some new diesels utilize a belt-driven overhead camshaft. The large, flat, ribbed object in this photo is covering the camshaft drive belt. If your engine has such a belt, replace it at the specified interval and carry a spare. While you might not be able to replace it yourself—it's a bit more involved than ordinary belt replacement—a trained mechanic can do this without difficulty.

Fuel system spares should also include a length of fuel supply and return hose. These are usually of different diameters, so you'll need at least two lengths. How long should these be? Because it is unlikely that you'll have to replace an entire run, 6 or 10 feet of each is usually sufficient. Add to this at least four brass hose splice connectors or menders, two in each size. These short, barbed pipe lengths



are designed to connect two pieces of like-sized hose. This will facilitate a temporary repair in fuel supply or return line, until a continuous-length replacement can be installed. My recommendation is to avoid permanent splices in fuel supply and return lines, as they invite both fuel and air leaks.

Because air is a vital component in the diesel combustion process, I'll include a replacement air filter in this section. Most new diesels are equipped with automotive-type pleated paper air filter elements. Although these filters usually don't require replacement as often as their automotive brethren and most marine engine rooms are not very dusty, they do wear out, disintegrate or become contaminated with oil, fuel or coolant. It's best to keep the replacement filter in a sealed plastic bag to prevent dirt or moisture damage. In fact, most replacement and spare parts should be stored in this fashion to prevent moisture contamination. Ferrous metal parts—such as fuel injectors, high pressure metallic fuel lines, alternators and starters—should be coated with a rust inhibitor (CRC 6-56, for example) before being placed in a Ziploc or other well-sealed plastic bag. If, however, you coat any electrical components, such as alternators or starters, in this way, be sure to thoroughly clean the corrosion inhibitor, which is an insulator, from any electrical contacts before installing the parts.

For long range and remote region cruisers or self-sufficiency enthusiasts, the fuel spares list will be incomplete without a fuel lift pump, full set of injectors, high pressure injector lines (these are the steel fuel lines found between the injection pump and the injectors) and an injection pump.

Expect the final item on this roll call of less commonly replaced parts, the high pressure injection pump, to cost more than your first—and maybe even your second or third—car. Depending on engine size and manufacturer, the injection pump may come with a price tag of well over a thousand dollars, or perhaps several times that. Injection pumps do not fail often—unless seriously contaminated with grit or water—usually running hiccup free for thousands of hours. So, weigh the odds, and your checkbook, accordingly: Where will you cruise, what will your access to service be like, etc.

ENGINE COOLING SYSTEM

The importance of this engine subsystem is undeniable; a small but vital complement of spares will keep the temperature gauge in the green. Not

surprisingly, the raw-water pump impeller tops the cooling system spares list. If you replace this at least every other year, or every 250 hours, it is unlikely that it will ever fail. Customers who leave the maintenance of this comparatively inexpensive yet critical item in my hands can expect to have it replaced seasonally. It's simply cheap insurance. Also, with each replacement comes an opportunity to inspect other internal pump components, which are discussed below.

Impellers do, however, occasionally fail, particularly if weeds, barnacles or the now sadly ubiquitous plastic bag blocks the raw-water intake. Lay in at least one spare and a supply of non-petroleum-based lubricant, such as Petrolatum or Teflon grease, to aid in installation and prevent damage during new impeller startup.

The raw-water pump itself, in addition to the impeller, contains a veritable plethora of replaceable parts and components. These include the cover plate, back or thrust plate (not a separate component), spare cover plate attachment screws, cam (make certain yours is supplied with a spare screw and O-ring) and oil and water seals. The oil seal is only found on gear driven pumps; belt driven pumps do not require this item.

The alternative to all of the aforementioned bits and pieces is a complete replacement pump. As mentioned earlier, if you are uncomfortable rebuilding a pump, or even replacing an impeller, it is often much simpler to replace it en masse. Then you have the option of rebuilding the old pump on the galley table at a leisurely pace while sipping a glass of Merlot (I find this sometimes aids in understanding the instructions) while you lie safely at anchor.

In addition to the raw-water pump and its various components, your cooling system spares should include zincs for your main heat exchanger and any other raw-water-cooled auxiliary heat exchangers, such as the transmission cooler. Did you know that some of these are equipped with dedicated pencil zincs? A replacement thermostat, although not a commonly troublesome item on freshwater-cooled engines, is too inexpensive and small to leave ashore. Ensure that your spare thermostat includes a new gasket or O-ring; the old one invariably comes off in pieces.

Although thermostats rarely fail, some individual heat exchanger components are notorious for their propensity to pack it up when it's least convenient.



Essential engine fluids and filter, left to right: Specialized coolant that is appropriate for your engine (this is a particular issue for new diesels, which often specify proprietary nonmix coolants), hydraulic fluid for steering system, primary fuel filter element (one is never enough) and crankcase oil.

These include the end caps or plates (disc-shaped parts that look like miniature teacup saucers) located on the ends of most heat exchangers. They will often develop small cracks around the fixing bolt that usually appear while this fastener is being torqued. This chain of events, sometimes called a "cascading failure," often occurs after you've removed this plate to clean out the blades of a failed impeller. If you are equipped for it, however, it is a virtual non-event.

Part and parcel with end plate spares are their associated rubber gaskets and O-rings. All three of these parts are usually sold as separate components from the engine's manufacturer, so be sure to order them all, at least two of each for double-ended heat exchangers.

A word of caution is in order for end cap or gasket replacement; resist the temptation to over-tighten these seemingly indestructible steel discs. Their construction usually includes a subtle cone shape, which assists in gasket sealing. Over-tightening this cone is the leading cause of cracking.

Of course, it would be foolish to even consider shoving off without at least one spare of every fan belt. For older engines, this may mean several V-belts. Most newer engine designs utilize the now common ribbon-like serpentine belts. These have been a boon to both the automotive and marine industries. They take the headache out of multiple belt replacement as well as the heartache of accessing the first or deepest belt on an engine equipped with two, three or more belts. Most serpentine belts are also self-tensioning, so



This shouldn't be your only "spare" coolant. Lay in a sufficient supply of coolant in order to deal with a leak. If your engine calls for conventional diluted coolant, consider making up a 50 percent solution for ready use. Be sure to mark the container as premix and use only distilled water for this application.

there are no more worries about getting that right, either. For all their attributes, however, serpentine belts do have one shortcoming. In order to "unload" the tension on the self-tensioning device, a leverage-inducing device is required, usually in the form of an extended socket wrench handle or a breaker bar. I cannot overemphasize the importance of ensuring that you are properly equipped for, and well versed in, using this tool. Practice replacing your serpentine belt dockside, not only to ensure that you are comfortable with the procedure but also to make certain your tools will do the job.

Once again, for the serious cruiser and spare parts aficionado, the following spares should be considered veritable necessities: a coolant circulator pump, a complete primary heat exchanger, crankcase oil and transmission coolers, the last of which are subject to galvanic corrosion because of their exposure to raw water.

ENGINE ELECTRICAL SYSTEM

Today's diesels are progressing, or perhaps I should say regressing, into microprocessor territory. Fully electronically controlled diesels utilize a wrist-sized wiring harness, and all the complexity and failure potential that goes along with it, that would put any gasoline engine to shame. Even ordinary diesels utilize electrical components that will either shut your engine down or impair its operation should they fail. These are worth keeping aboard as part of your engine spares complement.

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Spares



You're not likely to carry spares to resolve this failure. It's probable that the transmission these parts fell out of was destroyed because the wrong fluid was used for lubrication. It's important to carry spare parts and fluids; however, it's more important that they be of the correct type and variety.

Most diesels utilize a main wiring harness circuit breaker, which resides somewhere on the top or side of your diesel. It's easily recognizable as a 3/8-inch-wide red button that is often stamped with a number representing its capacity in amps. If your engine should ever fail to crank but your electrical panel voltmeter indicates voltage, check this breaker to determine whether it has tripped. You might save yourself an expensive service call. If, however, the breaker fails to reset—and this does occasionally happen—you'll be prepared with a spare.

Replacement is usually straightforward; however, make sure you shut the engine battery disconnect switch before carrying out your repair. Unless you do this, you'll be working with one wire—the "line" side of the breaker—that is energized and not overcurrent protected: a potentially dangerous combination.


Key switches are also known to fail occasionally, particularly as they age. Enthusiastic key insertion and salt air take their toll over the years, leading to eventual failure. Most key switches can be replaced in less than an hour, even if you've never worked under the dash before. Again, make sure all circuits are de-energized before entering this area with a screwdriver.

An alternator belt is an obvious mandatory spare part that no vessel should be without. All of the fan belt admonitions mentioned in the cooling system section apply for alternator belts. If it's a V-belt, ensure that it is of not only the proper length, but width or section as well. If it's a serpentine belt,

make sure you can—and have the proper tools to—replace it. It's worth repeating: Practice doing this dockside, even if it's just once.

For long range, conservative cruisers, particularly if your trawler possesses no means of onboard battery charging other than the alternator, for example, and you don't have a generator that can power a shorepower charger, you may want to consider carrying a spare alternator. It should be identical to the already installed alternator in every way, including case configuration, stud sizes and auxiliary wires. If that alternator is equipped with an external, "smart" or multistage regulator, then you would be wise to carry a spare one of these, as well.

Also, for the long range, self-sufficient cruiser's kit, consider carrying a starter (or at least a spare starter solenoid, which is the starter subpart that most often fails) and glow plugs or an air preheat element, whichever of the two your engine utilizes.

Once again, for those traveling far afield for extended periods, lay in engine and transmission oil filters, oil and transmission fluid. Although you may be able to obtain the proper grade of diesel oil and transmission fluid virtually anywhere in the world, getting the proper filters for your engine and marine gear may be more challenging. If space is at a premium, therefore, you may opt to forgo carrying enough oil for a complete change, stocking just spare filters instead. You should, however, no matter how close to home or assistance you cruise, carry enough oil for makeup in the event of a leak, but this may be considerably less than a full replacement quantity. The final entry in the long range cruiser's engine electrical spares list is an injection pump fuel solenoid. This is essentially the switch that turns fuel on and off when you start and stop the engine via the key switch. It's usually located within the pump (most generators use an external version that you can see move when the genset starts and stops) and is often beyond the skills of the average cruiser to replace. However, once again, having the right part is half the battle for getting under way. Find a mechanic and you've won the other half. 

In Part 2 of this series, we'll take a detailed look at spare parts recommendations for the rest of your trawler: domestic plumbing, sanitation, house electrical, running gear and other systems.

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