SHOOTING TROUBLE

CORROSION—RUST AND SCALE

Corrosion in the Cooling System—rust happens

Seawater is a harsh mistress for iron. Where there's moisture and metal there's corrosion, but seawater salts–notably sodium chloride–make this no garden-variety corrosion. Metal corrodes 5 times faster in the sea than in freshwater. Corrosion increases in an engine that sits a long while and causes more damage in enclosed areas–typically in engine cooling systems, where the water is. The cooling system is the largest cause of engine failure.

Corrosion in the cooling system comes not only from chemical *galvanic* action eating away the less noble of dissimilar metals (in seawater = electrolysis, *see vol. 8)*, but from rust and scaly buildup as well. Varying forms of corrosion all end in weak, decayed metal but may take different forms of prevention.

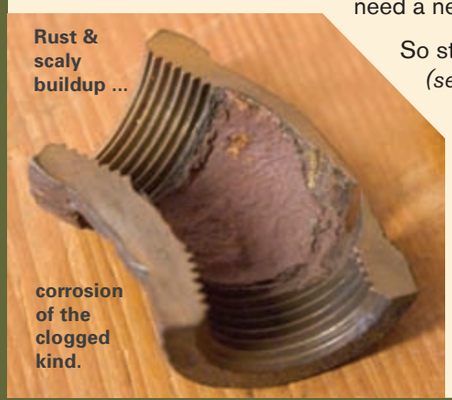
Most marine engines "rust out" rather than wear out. Salts in seawater (or hard freshwater) crystallize & build up scale inside the engine's water jacket & ports. This type of corrosion both weakens metal & coats it–not only damaging cooling systems from rusted-out leaks, but from rust & scaly buildup restricting water flow to impede heat transfer.

1/8" scale equals 4" steel in heat transfer.

Just as a blood clot in the leg can turn deadly when dislodged & carried to the brain or heart, rust and scale in the cooling system can turn deadly to the engine when dislodged & carried downstream to block heat-exchanger tubing.

Bringing water into the engine is always a tricky business that you just have to stay on top of. The problem is that most of the damage is hidden inside internal water passages. There is no accurate way to measure the damage and predict when the engine will fail. By the time you find leaks, discover heat-exchanger cooling tubes corroded through, or see water in the crankcase–the engine could be toast. Overheating can crack or seize cylinder heads, the block, & manifolds. Basically, could need a new engine.

So stay on top of it *(see box at right).*



MER EQUIPMENT

next issue: Erosion Corrosion

Routine maintenance is key to preventing a very expensive disaster. Based on water source, maintaining cooling systems boils down to 2 universal truths:

Raw-water Circuits–Zincs **Freshwater Circuits–Antifreeze**

3 TYPES OF ENGINE COOLING SYSTEMS

Raw water: Cheaper but scary; most corrosive with greatest potential for damage. Not seen much anymore save some pleasure craft or gas engines on lakes. Open circuit, piped seawater directly cools engine and transmission.

Freshwater Heat Exchanger: Actually 2 coolant circuits–one raw, one fresh–inside the boat. Raw (sea)water flows only through the raw-water pump and heat exchanger *(open circuit, where scaling occurs)* cooling the closed freshwater circuit that absorbs heat from engine and tranny. *Note: Heat exchanger cools the coolant from the engine jacket, not to confuse with transmission oil cooler–also exchanging heat but where water cools tranny oil.*

Keel Cooler: Closed freshwater circuit transfers heat to raw water outside boat through long coolant tubes mounted on hull beneath waterline *(with zincs)*. Coolant circulates through tranny oil-cooler before cooling the engine & returning to keel. Least potential for corrosion, highest reliability *(single centrifugal pump)*.

QUICK & EASY COOLING-SYSTEM MAINTENANCE

check your cooling, save the engine!

Raw-water circuits: ZINCS. Sacrificial zinc anodes screwed into engine water jackets, heat exchangers, or exhaust jackets. Routinely check & replace pencil zincs before 50% eaten.

Freshwater circuits: ANTIFREEZE. Contains rust and corrosion inhibitors to help keep system clean and undamaged *(see box below)*. Regularly test coolant & add SCAs *(Supplemental Cooling Additives)* as needed. *Note: Test strips expire, antifreeze depletes–renew and replenish for corrosion protection to work!*

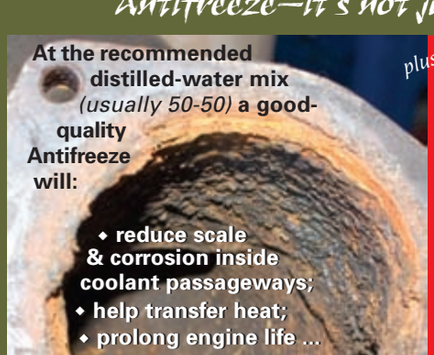
Hoses, clamps & belts: Visually check cooling system for signs of wear–*routinely*. Replace pinched, cracked or collapsed hoses, carefully check for corroded clamps, double-clamp any hoses below waterline should one fail.

Raw-water pump: Don't run dry! Check impeller–if burnt or broken look for rubber bits sucked into heat-exchanger tubes. If no impeller in the pump, it's in your heat exchanger. Before start-up always check that the seacock's open *(a good practice to shut when leaving the boat)* & check sea strainer for clogs.

Heat exchangers: Eventually if corrosion and dirt block the small cupronickel cooling tubes the engine will show a slow but steady rise in temperature. Clean or replace the heat exchanger. Might try back flushing, acid bath, removing for professional cleaning at the shop, or, if removable end caps, poke a wooden dowel or long skinny brush as if cleaning a rifle barrel *(careful–soft tubes!)*. Catch overheating early and, worst case–replacing the heat exchanger, not the engine.

Antifreeze—it's not just for freezing anymore!

USE CAUTION! Cooling systems can contain scalding liquid under pressure. Dispose of coolant responsibly–antifreeze tastes sweet but deadly toxic to kids & critters.



plus

- prevent gel deposits;
- reduce coolant evaporation;
- lubricate water pump & reduce wear;
- reduce cavitation erosion & liner pitting;
- increase boiling point of coolant *(in pressurized systems)*;
- and, yes–even protect against freezing!

Do not mix types or brands of antifreeze or SCAs.

(See related info on website in past newsletters: vol. 3, 4, 5, 8)

INSIDE!

THE BOATS THAT JD POWERED

National Fisherman's 2003 Best Of in the boatbuilding industry, Stewart Everest *(at right)* DBA Everest Marine builds Coast Seafoods' 3rd oyster dredge–*Willapa Express*–to join *Shellfish Express* and *Coastal Express* already working the Washington coast. All powered by JD 6081s, #4's in the queue for Penn Cove Shellfish.

Vessel length 63', 17'-beam, less than 2' draft.

Marine Engine & Repair

your premier provider of marine equipment, parts, and service—

since 1964

MER EQUIPMENT

338 W. Nickerson St.
Seattle, WA 98119 USA

In Seattle: 206.286.1817
Toll Free: 1.800.777.0714
Fax: 206.286.1917
Cell: 206.280.1090
www.merequipment.com

PENN COVE SHELLFISH—DEERES PUT MUSCLE TO MUSSELS

Each new oyster vessel in Coast Seafoods' growing fleet is powered by a John Deere 6081AFM keel-cooled diesel rated 330 hp at 2300 rpm, coupled to a ZF-305 transmission with 2.9:1 reduction. MER built the subbase to mount custom hydraulics off the front end through a 1000-ft-lb electric clutch running a Vickers 8-cu-in variable-displacement, load-sensing hydraulic pump. The high-volume, low-pressure Traktor Jet propulsion system moves the vessel well, pumping a lot of water very efficiently at low speeds & delivering high thrust per hp.

MER MG8.8 kW Isuzu genset; custom hydraulics on the Deere run propulsion jets for vessel's shallow draft.

Established in 1975 as a small family farm, Penn Cove Mussels started powering their operation with MER equipment back in '91 with an Isuzu 4BD1 power-set running hydraulics on their first oyster barge.

"Got 25,000 hrs on that first Isuzu," says co-owner and GM Ian Jefferds. Ian says he first found MER either by talking to Bob Allen at some boat show or calling around when looking to build that new barge. "Back when he had hair," he says, joking. "Talked to Bob and Mike, the rest is history."

A lot of history goes into this story–an intertwining story of Penn Cove and Coast Seafoods, of Everest Marine's new custom-built shellfish boats, and of the MER-made John Deeres that power them.

It's a story of partnerships, and begins with the Jefferds–the folks and 2 boys–seeding, growing, and harvesting mussels on Whidbey Island's Penn Cove, up at the north end of Washington's Puget Sound. Steadily building their hobby farm over the years the second generation eventually bought it out in 1986, passing ownership of Penn Cove Mussels to brothers Ian, Rawle, and Ian's wife, Karen.

This is where Everest Marine and boatbuilder Stewart Everest come in: "Since '86 just about everything they've hauled or harvested mussels with I've built," says Stew. "Skiffs, harvest barges, conveyor systems, boxing systems."

Ian says that partnership was forged when he bought a skiff from Stew's dad after happening by their North Sound Marine shop in Burlington, Wash.

"We were on the same page," says Ian. "He was one in a bazillion."

Ian Jefferds

The late Dave Everest served as WWII ship captain and NASA engineer who helped power the Apollo that landed on the moon. This really is rocket science–since 1978 the Everests engineered, built, and fabricated cutting-edge boats and equipment: Father and son pioneered the first fish pumps and designed the renowned Sea Bright, a superfast aluminum hull modeled on the East Coast's Prohibition-era wood rumrunners.

Today the oldest and largest commercial mussel farm in the U.S., Penn Cove ships worldwide, winning top honors for their premier product. To gain access to more oysters, clams, and a shellfish hatchery, in 1996 Penn Cove Mussels, Inc. partnered with the nation's largest oyster grower–Coast Seafoods Company, owned by John Petrie–to become Penn Cove Shellfish, LLC., spreading operations from the Cove down Puget Sound to Quilcene Bay and building a shellfish seed hatchery in Kona, Hawaii. As grower-harvesters, the joint-venture aquaculture and distribution company sustainably farms shellfish–seed production, growing beds, harvest, reseeding–selling seed and larvae to other growers as well.

Ian remembers his original 64-ft. mussel-harvest barge as "a real Rube Goldberg," & says that at first he didn't put a big enough power system on it: "The more I learned about hydraulics the more I realized we were underpowered." But over time, he says, "we ramped it up slowly."

Coast Seafoods wanted a better oyster barge–big enough to carry large loads, shallow-drafted for greater access to tidelands, & fast enough to deliver & off-load quickly between harvest tides to allow maximum time on the grounds. They wanted a big, shallow, fast boat, contracting the design project to Penn Cove partner Ian, who partnered with Stewart–now Everest Marine–to build it.

The team designed a big, shallow boat, 63 ft. of gleaming aluminum with 17-ft. beam & less than 2-ft. draft–and then they built 3. Her waterline depth just 20 in. at the transom (at the jet), *an average 10-in. draft,* the boat's designed to pack 40 tons of product. Low-slung for exceptional handling in wind, she can dredge in 3 ft. of water–half what the other boats need.

Fast is where John Deere comes in–& once again, Ian turned to MER.

"We went to John Deere when we started building these new oyster boats for Coast Seafoods," says Ian. "I looked around the boat shows & power suppliers. I called Bob–I knew him. He worked with North American Marine Jet to come up with the best combination of power and jets–how much power do you need, how much power can you afford."

PHOTOS COURTESY PENN COVE SHELLFISH

"Bob figured out the best match-up," says Ian. "Same with the best power and tranny that works best with that jet." Ian bought his first John Deere 6081 in '05; this is his third.

"They supply the most power and most reliability for the best dollar," he says. "More bang for your buck. All the things they put in a sales brochure, it's very accurate with John Deere.

"Went with the second one because Bob at MER made it real easy. We put 'em in, everything fits right, they run well. Made it easy and they work great–they're reliable."

The 6081 also powers the hydraulics for the self-unloading tilt-up deck, off-loading conveyor, cranes, water pumps, davits–Stew calls the Deere "a real workhorse."

Shellfish Express

"John Deere I like because of the rugged use I can put them to," says Stew. "I'm extremely happy with it for these boats."

Stew originally had two JDs in mind:

"Thinking about speed to begin with," says Stew. "I designed it for twins. More speed–more time on the grounds." He says it's a planing-hull design without the power to plane, and needs the twins to get the 16 to 18 knots planned.

"These boats were so efficient," says Ian, they opted to use a single Deere: "They can get a lot of work done on a tidal run. The shallow draft of the design has provided the efficiency we're really looking for."

The single JD 6081 still achieved launching speed of 12.5 knots at 2400 rpm dry; cruising speed 8.5 to 9 knots at 1700 rpm with all the gear aboard and full tanks; dredging at 4 knots, with 1600-1700 rpm the optimum to work hydraulics. Fuel consumption averages 5.87 gal/hr–when on the grounds slowed to 6.7 knots the engine's running 1,000 rpm and using only about 1.5 gal/hr.

"I make a model first," says Stew, "and experiment with scaled weight moved around in the hull to see how they trim out. The hull likes the wind better with ballast and the added 16,000 to 20,000 lbs. doesn't change the speed of the hull, it's still the same as launching."

Quick to give credit to the boatbuilder and engine dealer, Ian pokes fun at how little he knew and how much he's learned along the way.

"Bob was the one that really came through," he says. "He lays it all out & makes it real easy. Other options out there didn't match up.

"And Mike's the electrical guru from the generator standpoint–engines too. Service has been excellent. We can get parts easily; they ship parts to the coast. They've been a great company to deal with."

Ian also honors the memory & legacy of Stew's dad, Dave the rocket scientist, & says that after completing the last boat:

"We both knew he was looking down on us," says Ian. "He was proud of what we rolled out the door."

Shooting Trouble

EMISSIONS–Bob Allen on Yanmar/BMW Tier II

Discount Coupon

MER EQUIPMENT

20% OFF your next PARTS & ACCESSORIES purchase before May 15, 2007

2007

The fine print:
- *Not valid with any other offers or online discounts.*
- Based on standard MER list prices.
- One per customer.
- Expires 5.15.07

1.800.777.0714

- Bring in coupon or call today to apply to your order.

The EPA is driving traditional competitors into bed together–the latest, BMW and Yanmar.

Rather than reinvent the wheel to replace the non-compliant 4JH & 270-hp 6LP, Yanmar searched the world market for a proven diesel that meets newly mandatory Tier-II emission regulations for recreational and light commercial diesels.

They found the 4- & 6-cyl. BMW diesels from Stuttgart, Germany–I suspect after a Yanmar engineer drove the new diesel X-3 SUV and said, "Wow, this would work for us." Lightweight, low-vibration, high-quality, high-hp engines with computerized high-pressure common-rail fuel systems that are state of the art. They run uncommonly quiet and smooth, idling at 650 rpm and developing from 150-260 hp depending on model and computer fuel map.

Our Service Manager Herb Knight and I went to Georgia's Yanmar Marine Plant for a week's intensive training class on mechanical & electrical systems for the new BY series diesels.

Skeptical at first, it challenged everything I know about diesels: no more mechanical governor, throttle, or shifting. Now it's all computer, & the engine load determines fuel delivery–if the load doesn't need fuel, the computer doesn't deliver it. At full rpm the high-pressure piston pump delivers fuel to the fuel rail at 23,200 psi; computer-controlled injectors are more accurately described as solenoid-controlled diverter valves.

The computer can deliver multiple injections per piston stroke, at variable fuel volume, yielding smoother power delivery to the crankshaft & a more efficient fuel burn–increasing usable power from the fuel, reducing exhaust emissions *(particularly NOx–Nitrides of Oxygen, & hydrocarbons–unburned fuel)*.

High-Pressure Common Rail (HPCR) is growing quite common among manufacturers, the HPCR & computer-controlled injectors proving the most effective systems in meeting ever-higher emission standards.

The Upside: better fuel economy, less noise, low vibration, smokeless operation, cleaner environment, less global warming, yada yada. Downside *(always a downside)*: Some of our favorite tried-&-true, ultra-reliable, *simple* diesel engines disappeared from the marketplace. We'll need a computer to diagnose, modify, or repair the fuel system–engine won't even run without the computer unless maybe to limp home at idle.

YANMAR Diesel Power

Spare-parts lists change. LED readouts give us: *engine load, fuel consumption, total fuel delivered, fuel pressure, crankshaft position relative to camshaft position, return-line pressure, exhaust temperature, turbo-boost pressure, intake air temperature.* We have automatic synchronizing for twin applications–plus electric shift, electric trolling, & multiple electric throttles as well.

We can program all the above to our personal preferences–it's no longer your grandfather's or even your father's diesel engine. Now there's a laptop in every diesel mechanic's toolbox.

For most of us that means a *huge* learning curve, challenging & frustrating at the same time. We're getting calls from customers with *P* codes *(universal trouble codes)* they never knew they had before.

Time was–you had fuel, air, compression, & timing–any diesel will run. Now, add an ignition-control signal. Time was could unplug the battery after starting the engine. Those days are over.

We all know that most trouble in a boat's gas engine is in the ignition system. Now they're in our diesels too–not technically, it is still compression ignition. But without the computer controlling fuel delivery, it's not gonna run. All those new fancy features come at a price.

So stay alert when installing: Keep computer, throttle potentiometer, wire-harness connections away from moisture, heat, & vibration. Check electrical connections regularly for corrosion; stock dielectric grease for protection. Invest in a good Fluke meter to troubleshoot electrical components. Know your low-voltage relays, timers, diodes, solenoids: how to test, & carry spares.

Other than all that–piece of cake.

when computers control your engine– SIMPLE DO'S AND DON'TS

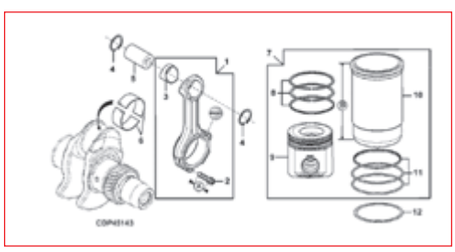
- **No. 1 cause of ECU failure (Electronic Control Unit):** Welding on the boat without unplugging the ECU. It's a *computer*—wouldn't run 250 amps DC through your laptop, would you? Just unplug it whenever you feel the need to pull out the welder.
- Install the ECU & electric throttle in a nice, warm, dry environment; make sure all connection wires lead down from the ECU (keeping moisture from traveling down a wire to the unit) and keep all harness connection points out of the water. The computer's signals are low voltage and low amperage–it relies on a system of relays, timers, & switched solenoids to control the engine.
- Know your engine's electrical system well; keep current wiring diagrams onboard to reference & troubleshoot.
- Low-voltage controls allow smaller wire & connection points *(miniature connections are more susceptible to corrosion)*.
- Use dielectric grease on all plug-in connections–it does not conduct electricity. (Ordinary grease will conduct current between pins; use that on a computer plug? it's *Smokin'!*)
- Resist the urge to cut the wire harness when installing new components, senders, or safety devices.
- Remember: watertight plugs in harness connections, heat-shrink protectors on wire looms.

merequipment.com

New Parts Store–*open for business!*

$ave $ome Money: self-service discounts up to 30% when ordering online

We continue to develop our website to better serve you. Our Parts Manager, Mark Miller, uploaded rebuild and replacement parts catalogs for most MER John Deere lines as well as Cowl and EM exhaust products. You will find graphics, descriptions, helpful tips & exploded diagrams to help you search for and identify the part you need.



Get to know your John Deere engine option codes and you not only get discount prices, but 24/7 service! What's an option code? Each John Deere engine component group has an assigned code with unique part numbers for parts groups and accessories.

Option codes typically are listed on the engine (that long list of 4-digit numbers on the engine label). If the label is missing, email or call us with the serial number & we'll look up the correct codes for you. If you know the part number you're already there & can skip the codes.

Online discounts can be big–up to 30%-but only if you place the order online. We'll be happy to answer questions, but regular prices apply when placing the order by phone or in person (use the coupon).

Next project will be online parts for Yanmar, ZF, & Isuzu with some exploded diagrams you can mouse-over to see part names + tips on related parts you may need. We'll also add technical information for different specs and eventually sell special tools online as well. *Stay tuned & visit often.*

You can order John Deere plus Cowl & EM exhaust parts online now!

www.merequipment.com
info@merequipment.com

Shop til you drop & $ave Money–24/7

MER EQUIPMENT
338 W. Nickerson St.
Seattle, WA 98119

The MERmade Mechanic

PARTS COUPON
+ PARTS ONLINE

www.merequipment.com

News You Can Use!

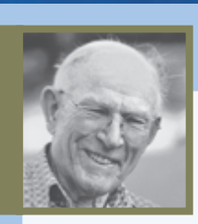
Vol. 9 Spring 2007

MER EQUIPMENT

The MERmade Mechanic

MARINE ENGINES & REPAIR COMPANY, INC.

Inside: **Keep Corrosion from the Cooling System**
Save $ Online • New Penn Cove Boats
New Yanmar Diesels ... & *Ivan Fox*



From the Founder

Ivan Fox Remembers ... THE LOGGER

Ivan worked for San Juan Fishing & Packing Co. in 1948 when they bought the 105-ft. power scow Logger *from a SE Alaska logging company. Built in '44 by Maritime Shipyards in Seattle, San Juan used the* Logger *on Kodiak Island working for the Uganik Cannery at Port O'Brian in the Northeast Arm of Uganik Bay–brailing traps, tendering the fishing fleet, & hauling freight north in the spring of the year, mostly lumber and trap wire to build their 7 salmon traps. When traps became illegal after statehood the company built up their seine fleet which fished all around Kodiak Island & the mainland between Cape Douglas & Kilokak Rocks.*

In 1960 the trend was to refrigerate fish holds by chilling seawater. Since we had to range further following our fishing fleet we decided to tank the *Logger* and install refrigeration equipment. We installed 5 tanks on the deck of the *Logger* under the shelter deck, 3 forward and 2 aft, with a total of 8400 cu. ft. When fully loaded we had enough salmon to can 5000 cases of 48 1-lb. talls. In late August 1966 we closed the Uganik cannery for the season. A late run of chum salmon showed up in Kukak Bay on the mainland. We had 10 boats that went over for the opening and we sent the *Logger* over to tender the fleet. The salmon was to be taken to Kodiak to be canned by Ocean Beauty. After 2 days of fishing we had 160,000 lbs. of fish onboard, the fleet had quit fishing, & the *Logger* departed for Kodiak.

Early that afternoon we received a radio call–the *Logger* had run aground in Kupreanof Strait about a quarter mile east of the entrance to Onion Bay. The captain had set a course with the autopilot and fell sleep. We immediately loaded some equipment aboard the power scow *Viekoda* and headed out to the stranded *Logger*. The bow was up on the rocky beach. When we arrived at the site Chuck Turner, manager for Kadiak Fisheries, was there with the vessel *Robert M.* to give assistance. The tide was flooding and we hooked up a towline; after a couple hours the tide was high enough to tow the vessel off the beach. The *Robert M.* took a strain on the line and the *Logger* came off and immediately started filling with water. I remember Turner standing on the afterdeck with an axe to cut the towline in case the *Logger* sank. The *Logger* was rapidly filling with water as we towed it out into deeper water. It was sinking with the weight of the tanks on deck as well as the weight of the salmon onboard. The vessel's center of gravity changed and it rolled over.

Next issue: Saving the Logger *with luck & Yankee ingenuity. (Built 1941, fire destroyed* Viekoda *Feb. '07–first power scow in the Alaska fishing fleet.)*