FLUKE®

Harris Electric keeps the current flowing for Northwest mariners

Application Note

Testing Functions **Case Study**

With her spotless white superstructure rising above a glistening black hull, the immaculate vessel moored along the Lake Washington Ship Canal in Seattle looks more like a yacht than a fishing boat... and nothing like a factory.

Yet the C/P (catcher-processor) Starbound is both: a 240-foot (73-meter) traveling processing plant that spends months at a time at sea, netting pollack and Pacific cod from icy Alaskan waters and processing the fish into fillets and roe.

Tools: 87V Digital Multimeter, 1735 Power Logger, ScopeMeter® portable oscilloscope, VoltAlert™ voltage tester

Applications: Run capacitance test, check for proper grounding, record performance of a ship's electrical system, detect noise in electronic cables and circuits, troubleshoot voltage

Customer: Harris Electric

High on the bridge, the crew scans the whitecaps and studies their radars, fish finders, and net-positioning instruments. Down below, the crew works 16-hour days in the processing plant—a tight space densely packed with stainless steel processing equipment—turning pollack into table-ready goodies. Still farther below, just aft of the engine room where the nine-cylinder main diesel beats out its 4,950-horsepower rhythm, engineers monitor the panels of programmable logic controllers (PLCs) that connect them to electrical and mechanical systems throughout the boat. Behind the engineers' station stands a 30-foot-wide (9-meter-wide) switchboard designed, built, and installed by the company Northwest mariners depend on: family-owned Harris Electric of Fisherman's Terminal, Seattle.

"If it floats, we do it"

Founder Jack Harris set up the business in 1928 to do both shore-side and marine electrical work. Swedish immigrant Arvid Ohman joined the company soon after, doing electrical work in the winters and fishing in Alaska in the summers. Ohman took over the company in the midst of the Great Depression, retaining the Harris name in part to use up $75 worth of company letterhead. Another Swedish-American, Victor Sundholm, joined the outfit in the 1930s, and bought the company in 1959. Vic's son, Dick, now serves as board chairman and grandson Erik is vice president.

Today some 90 percent of Harris Electric's work is marine projects, split about 50/50 between electrical and electronics jobs. In addition to the main shop in Seattle, Harris operates year-round at Dutch Harbor, Alaska and in summers at Bristol Bay. The company handles design, installation, and repair; manufactures switch panels like those on the Starbound; and maintains radar systems on the 24 state-owned ferryboats that ply Washington's Puget Sound. "If it floats, we do it," said Dick Sundholm.

Taking measurements in a programmable logic control (PLC) panel on the Starbound.

Marine work is "way more technical than wiring buildings," Sundholm said. Crews specialize in either electrical or electronics work, with little crossover. "I guess that's just human nature," he said. And what's different about work aboard a ship? "Almost everything is in stranded wire because of vibration," Sundholm said. "And in today's world there's a lot of shielded wire because the electronics are so sensitive to stray spikes and interference. Everything, especially around the bridge, needs to be shielded and grounded."

An unfriendly environment

It's no small issue. Ten years ago, Sundholm recalled, a catcher-processor vessel lost its steering and struck Seattle's Pier 91. Circuits that were not properly grounded and shielded knocked out the electronic steering system and the ship went out of control. It was not a Harris job.

Damp and salty, the marine environment is not friendly to electrical installations. "Corrosion is a big deal," Sundholm said. "We need to use corrosion-proof or corrosion-resistant material, a lot of stainless steel, and nowadays plastic boxes, waterproof boxes, waterproof entrances into the boxes and into the house from the deck—all that kind of stuff."

Codes governing marine installations are less detailed than for shore-side projects, Sundholm said. The US Coast Guard regulates some activities, and the insurance industry, the American Bureau of Shipping, and the risk management organization Det Norske Veritas (DNV) also provide guidance. "Good marine practice" serves as the bottom line.

Harris customers are *Deadliest Catch* rugged—Harris services many of the vessels featured on the hit Discovery Channel TV show—but their world and their vessels are changing. Once they left powerful sodium-vapor deck lights on day and night because the added electrical load helped to keep diesel engines throttled up and running cleanly. But Harris electrical engineer Bob Lindberg said newer engines run cleaner, and high fuel costs have changed that equation. Today, skippers want to save fuel by cutting back on power use.

Ensuring clean power

Another change: today's vessels are awash in sophisticated electronics. Radar, sonar, depth finders, global positioning systems, vessel tracking systems, fish detectors, steering, engine controls, net handling equipment, and more are managed electronically and often report through multifunction displays. It's important to keep power cables shielded or adequately separated from electronic circuits, to prevent electromagnetic inductive coupling or cross talk from affecting instrument readings or control circuits. Harris technicians use the Fluke ScopeMeter® portable oscilloscope to detect noise in electronic cables and circuits that could interfere with useful signals, and check for proper grounding using Fluke digital multimeters. Lindberg said part of the job for Harris is to update older wiring to prevent cross talk problems.

It's also important to make sure electrical power is clean. The same soft-start devices and variable frequency motor drives that help preserve equipment and save energy can create harmonics that cause electric power problems. Such "dirty" power causes inefficiency and can damage electrical components. Lindberg said the accumulation of too many harmonics can cause components to overheat. Harris has a solution.

Using the Fluke 1735 Three-Phase Power Logger, Harris technicians record the performance of a vessel's electrical system—voltage, current, power, power factor, and harmonics—long enough to capture a full operational cycle. They then send the test data to HBT International, an Icelandic company that custom builds the ElCorrect power quality correction system. If HBT's analysis determines that ElCorrect can solve the power quality problems that have been detected, a system is built and shipped to Harris for installation. In the right circumstances the system can reduce energy consumption, lower maintenance needs, and improve overall operations.

Harris recently installed a power correction unit on a vessel that uses diesel-electric drive. "When you're generating your own power you inherently create some of your own issues," said Todd Shattuck, manager

of the Harris marine electrical division. The boat in question uses silicon-controlled rectifiers (SCRs) to control power at the propulsion motors. "That in itself will create some dirty power for you," he said.

Keel to crow's nest: Jim Potts is on duty

A member of International Brotherhood of Electrical Workers Local 46 in Seattle, Jim Potts has worked as a field marine electrician for more than 35 years. He knows the Starbound from stem to stern, and there's a lot to know. Unlike a factory on shore, Starbound must provide living quarters for a crew of 100, move under her own power, navigate to and from the fishing grounds, find fish, operate her trawl nets…and in addition, do all the work a shore-bound food processor would do. It requires extensive electrical and electronic systems to monitor and control all the action. "The most expensive system on most of these boats is the electrical," Potts said. "From the top of the mast to the bottom of the boat, there's almost nothing that's not connected to a cable or sensors somewhere."

Shipboard ac voltages go as high as the 480 volts common in commercial work, Potts said, plus there are a multitude of dc circuits for control systems and pilothouse electronics. Potts and the Harris crew have been updating the 22-year-old Starbound by replacing older electromechanical controls with programmable logic controller (PLC) systems, most running on 24 V dc control voltage. The vessel has dozens of sensors for position, temperature, and pressure, Potts said, and more than 120 different alarms to alert the crew to changing conditions. The fish processing or factory area, too, is PLC controlled.

"We also do refrigeration," Potts said. "They have massive refrigeration on this boat—four 300-horsepower units, with two 1,600-kilowatt generators, plus the 3,400-kilowatt shaft generator. And we've rewired all of that."

High above deck, Potts watches for problems with the high pressure sodium- and mercury-vapor lamps used to light the decks. "All those systems have capacitors. If a light's out the first thing we do is go to that capacitor and use the capacitance test on the Fluke 87 [Series III Digital Multimeter] to make sure the capacitor's OK."

A high-stakes game

All electrical work is important, but marine work raises the stakes. When a building or factory has electrical problems, help can drive right up to the door. And there's no danger of sinking. But those who command vessels thousands of miles from land and work in some of the world's most treacherous waters expect and demand something extra. They come to Harris Electric.

Jim Potts tests continuity in the power control panels Harris built and installed deep in the Starbound's interior.

Works...and keeps me working: my favorite tool

Ask Jim Potts what's his favorite Fluke tool and he doesn't pause—it's the Fluke VoltAlert™ Non-Contact Voltage Tester. "For your ac troubleshooting, that's the most innovative tool I've seen," he said. "If there's one tool you've got to have on a boat to start with, that's it. I've got one in my car, one in my house, probably two in my truck and one in my bag and my pocket.

"I mean, you open up a panel—we've got panels and switchboards that stretch from here to that alarm—and you've got dc and ac circuits all tapped on one term strip. It's the first thing you take out of your bag. You can see what's on and what's not. A lot of times we'll have multiple feeds into one panel. It'll be on two or three different breakers, and you don't know what's in there when you go to troubleshoot. You take that little tool and run it around and you can find out what's there real quick—if it's going to hurt you or not. If there's any question about whether a circuit may or may not be off, I'll take my multimeter and verify it."

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