

## At Safeco Field, Fluke tools touch all the bases

**Vance Akres has moved the 13,000-ton roof of the Seattle Mariners' Safeco Field 150 times, and he's not even tired.**

Moving the stadium's three-panel, retractable roof requires Herculean effort, all right. Luckily for Akres and his crew, the muscle is provided by eight Allen Bradley drives, 96 Baldor 10 h.p. motors and an intricate system of circuits, transformers and panels as closely monitored as Ichiro Suzuki's batting stats.

A roof that moves makes sense in Seattle. Confined for 20 years inside the indoor Kingdome stadium, Mariners fans craved a return to outdoor baseball and all that means: grass fields, the sun in your eyes, wind in the outfield that can carry the ball in an unexpected direction, and the sound of a train whistling by. But that didn't mean they wanted to get wet.

It doesn't rain hard in Seattle, just often. So the same company that constructed the giant sea cranes that move cargo in and out of the Port of Seattle scratched its head, conjured up its technical expertise and created a paneled roof that can be moved into place when Seattle's gray skies turn drizzly.

### No time for delays

With the help of sophisticated weather monitoring equipment, the roof crew is constantly on the alert for weather patterns heading into the area. Ultimately, the decision to open or close the roof during a game is made by the Mariners' team president. At other times the roof is closed or opened to accommodate maintenance needs or other events. The entire roof mechanism is automated; a specially designed computer system guides its operators through the entire process.

Over the course of Safeco's first seasons, whether the roof is open or closed has become a common fact of discussion in the area, one likely to be mentioned in radio and TV broadcasts. Because of the aerodynamic differences inherent in a closed stadium compared with an open one, when and whether the roof

## Application Note

was opened or closed figures as much into fans' post-game arm-chair managing as any umpire's call.

To avoid a rain-induced game delay, the roof needs to move on command. When given the signal, the system cycles through a series of safety checks, then begins to move into place, almost as if by magic. Each of the three panels moves independently, at a speed from 30 to 60 feet a minute, all calibrated to ensure the panels "get to their parking spots at about the same time," said Rob Wolford, the Mariners' roof maintenance mechanic.

Wolford came to Safeco after a career as a U.S. Navy submarine electrician. Responsibility for a baseball stadium's roof mechanism is more fun, he said. "Better view," he joked.

### Battling moisture

Not surprisingly, battling moisture is one of the crew's most constant challenges. "It's the basic principle," Wolford said. "Moisture and electricity don't mix." Even though the roof's motors are sealed inside metal casings, moisture routinely creeps in. "It doesn't matter what you do. Moisture will find its way in. No seal is foolproof." Because the crew can't risk a performance failure during a game, it relies on its preventative maintenance schedule. Wolford, familiar with moisture problems in the Navy, began placing desiccant crystals inside the metal casing to attract whatever moisture makes it through the seals. That simple maneuver has dramatically cut moisture problems, he said.





Akres and Wolford depend on Fluke test equipment to make sure the roof's moving parts stay in championship shape. Their T5-1000 electrical testers ride next to their pens in their shirt pockets, pulled out throughout the day to quickly test whether a circuit is dead or alive. A Fluke 177 digital multimeter checks voltages in the systems' many junction boxes, probing for shorts, and a Fluke 1520 helps the crew conduct its motor insulation tests.

Moving enough steel to build a 52-story building in ten minutes, all under the watchful eye of millions of people, requires the same basics as any type of electrical troubleshooting, they say.

Shane Morgan agrees. Morgan and his crew have responsibility for the rest of Safeco's electrical systems. From the roof down is his territory.

"The first thing I did when I got here was to get everyone these," he said, pulling out his Fluke 1AC tester. Then he brought in the Fluke T5-1000s his crew relies on today to keep the stadium's complicated electrical system working. Morgan's challenges are different than the roof crew's. His world is a constantly changing kaleidoscope of requirements and system improvements and problems.

"Everything works the way it is now," he said with half a grin. "Then food service will bring in a panini grill that pulls a lot of juice. Normally when we get a call, someone has set up something new."

Four Safeco Field electricians, including one lighting specialist, are responsible for everything from the sky-high floodlights that illuminate the field itself and the thousands of lights that make up one scoreboard to the heaters in the dugouts and the stoves in the pizza stand.

"Maintenance is the largest issue here too," Morgan said. "The biggest thing was establishing predictive maintenance. Now we keep track of when we change out what lights. We can't wait until they fail. We know how long each should last, and we change them out on a schedule."

### Dealing with harmonics

The stadium wrestles with harmonic and power quality challenges, Morgan said, based largely on the design of the stadium's original electrical system. The stadium was built with no filters. "We're getting a lot of third and fifth (harmonics)," he said. "Some sevens. It's probably the lighting." Each of the stadium's original circuits was 2,000 watts, built on a 277 system. That probably saved money originally, because it required half as many breakers, but is causing problems as stadium use grows.

The current goals are to chip away at the problem areas and to get the stadium's overall power costs down. "With the harmonics, our approach is to try to correct the problems downstream and work our way up to the transformers," Morgan said.

Morgan upgraded and expanded the cable patch panel electrical system satellite trucks use to broadcast Mariners games across the world. Because of the team's Japanese following, an HDTV truck remains permanently parked throughout the season, beaming the team's games across the Pacific.

The baseball season may be the main focus for Morgan, Akres and their crews, but it's not the only one. Safeco Field hosts everything from a World Wrestling Entertainment WrestleMania global broadcast to Microsoft annual meetings. It can be the site of a graduation party one evening and a home-plate wedding the next.

Baseball or retirement party, the Seattle Mariners are committed to making each use memorable, Akres said. "We want our fans to have the best experience in baseball," Morgan said, agreeing.

Which is why they carry Fluke tools.



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