FLUKE®

Fluke testers help hockey fans chill out at 'The Rock'

Application Note

Testing Functions
Case Study

Tool: Fluke 568 Infrared/Contact Thermometer, Fluke 971 Temperature Humidity Meter, Fluke RLD2 Leak Detector Flashlight

Testers: Tim Dougherty, Chief Engineer; Rich Framarin, Engineer; David Diehl, Engineer from AEG Facilities

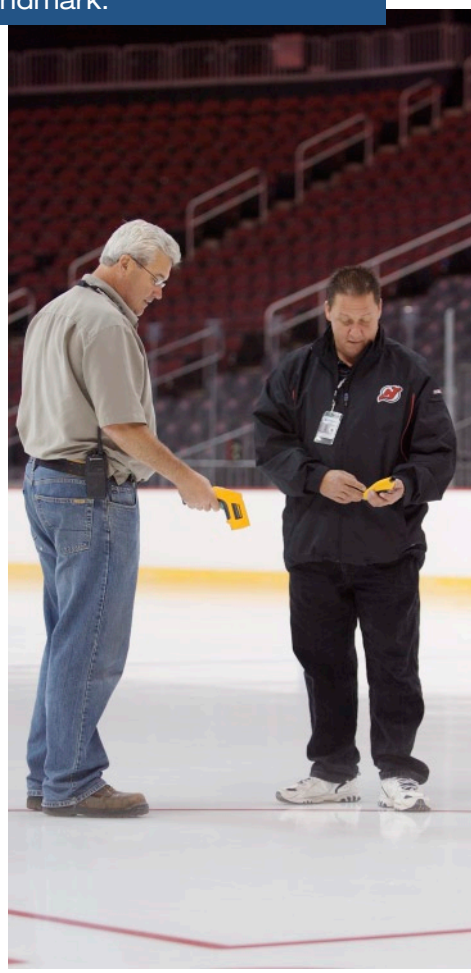
Tests: Checking surface temperature, air temperature and humidity

Less than a year old, the sparkling Prudential Center in downtown Newark, New Jersey is the newest sports and entertainment showplace in the nation's busiest media market—and the cornerstone in the renaissance of the city's urban core. Its dramatic facade, highlighted by two glass escalator towers, became an instant Newark landmark.

Its official name is the Prudential Center, but insiders have taken a cue from the Rock of Gibraltar logo of its title sponsor, Newark-based financial services giant Prudential Financial, and call this $375 million, 850,000-square-foot facility simply "The Rock."

Here the spotlight is always on. The Rock is home to two pro sports teams and Seton Hall college basketball, and provides a stage for world-class headliners like Jersey rockers Bon Jovi. Whether they're laying down a mirror of ice for a hockey playoff game with the home town New Jersey Devils or preparing for a concert by the demanding super group The Eagles (72 °F, please, and no drafts), The Rock's operations team has just one performance standard: flawless.

It helps that the facility is equipped with state-of-the-art mechanical systems, because conditions are demanding. From rink side to the 76 luxury suites, fans expect comfort as Newark's climate swings from bitter winter cold to extreme summer heat and humidity. In a matter of hours, the building goes from empty stillness to pandemonium as 18,000 fans fill the seats for a game or concert. Environmental systems have to keep pace. The ice must be perfect. The Rock is the perfect place to put Fluke tools to the test.



The science of precise ice

It's not an everyday environment, or a normal job. When he joined operations firm AEG Facilities at the Prudential Center, Chief Engineer Tim Dougherty, a member of Local 68 of the International Union of Operating Engineers, got a call from another AEG sports facility manager in Connecticut. "He said 'Get it in your mind that this is the entertainment business. You're in event mode all the time, because this isn't a regular Monday through Friday office job,'" Dougherty recalled.

So Dougherty and his team, Rich Framarin and David Diehl, stay busy checking ice and air temperature and humidity and monitoring the performance of mechanical systems until the last Devils player skates off the rink. That's why, during a break in a playoff game in April 2008, the telltale yellow of a Fluke 66 Infrared Thermometer was seen on TV across the U.S. as a member of Dougherty's crew spot-checked ice temperature. Few knew it, but fans were watching the final step in the complex science of precise ice.

It starts with a rink custom designed and engineered by CIMCO Refrigeration, Inc., the preferred supplier to the National Hockey League (NHL). The design includes four 175-hp compressors that provide a total of 375 tons of refrigeration capacity to ensure prime ice conditions on both the main rink and a separate practice rink. The Rock is one of only two NHL facilities with a practice rink.

Creating an NHL-quality rink is a complex process. The base layer is sand, crisscrossed by some 61,500 feet of plastic pipe. Warm water flows through those pipes to heat the soil and prevent permafrost from developing below ground. Insulation above this layer prevents the underground heat from battling with the cooling needed for ice.

In July 2007 a fleet of 45 trucks hauled 450 cubic yards of concrete to the site, where workers worked it into place over a network of 51,000 feet of steel piping that carries a glycol/water coolant throughout the slab.

After the slab cured, a layer of water was spread and frozen to form a layer of ice ¼ to ½ inch thick. This base layer was then painted white, with a second added layer used to lock in the color. More water was added, lines and logos were incorporated, and final layers of ice applied to reach the NHL-specified ice thickness of 1 inch. It's not just the thickness of the ice but its quality that makes all the difference, Dougherty said.

Frozen, but not static

For a material that's literally frozen, ice is far from static. It's still a fluid that changes physically as temperatures rise and fall. Its quality as a playing surface is influenced by its temperature as well as the air temperature and humidity above.

"If you don't have the right combination you'll start to see the chipping, you'll see a lot of snow, you'll see bouncing of the puck—that immediately tells me that we don't have good ice," Dougherty said. "It's very important that my engineers keep a tight rein on the temperature and humidity. I'm usually in the ice plant during the game, monitoring the ice. We make sure we keep those compressors running and we have a slab temperature of 17 °F to keep that ice temperature between 21 °F and 24 °F."

The surface wears throughout the game, so crews sweep shavings from around the nets during breaks, and then multiple times during a typical game, the Zamboni ice resurfacing machine glides back and fourth across the rink, renewing the surface with a thin layer of 160 °F water.

"Once the Zamboni floods the ice it's key to make that surface temperature come down," Dougherty said. "The surface temperature probably hits 29 °F or 30 °F when they flood, and I

Dougherty and his team sample ice temperature and air temperature and humidity at multiple locations.

have to maintain between 21 °F and 24 °F at all times. So I have to have a really good reading on the ice after it floods, because I have to make sure my compressors are removing the heat from that flooding to achieve the best temperature possible." The rink has temperature sensors in the slab and an overhead infrared sensor to monitor the surface, but Dougherty's crew verifies surface readings throughout the game with the hand-held Fluke 568 Infrared Thermometer. Ice temperature, however, is not their only concern.

"The surface temperature alone is one thing, but it really goes with the humidity and temperature," Dougherty said. "If it's too warm or humid, that's really going to affect the surface of the ice. There are three factors here: the surface temperature being 21 °F to 24 °F, the air temperature being 60 °F to 64 °F and humidity, there's got to be a really tight rein on it, between 40 and 50 percent." Humidity that's too low—18 to 20 percent—will remove moisture and dry out the ice. Excess humidity will wet the ice. To check air temperature and humidity above the skating surface, the crew uses the Fluke 971 Temperature Humidity Meter.

All the instruments at our disposal

Communication is also a critical factor. "You have to have communication with your Zamboni driver, your ice crew, the guys that are out there that are shaving the ice and laying down the water," Dougherty said. "The key in all operations I've done, not just here but in office buildings or research or manufacturing, is communication." Communication is what it takes to get the most out of The Rock's advanced systems and test equipment.

"We have all the instruments at our disposal to absolutely make the best ice possible," Dougherty said proudly. "We have desiccant units which control our humidity, we have state-of-the-art air handlers that control our temperatures, and we have state-of-the-art CIMCO refrigeration units to maintain the proper ice temperature. One of the greatest things about the way this is designed is that our fan base no longer has to sit in an arena that is 50 °F in temperature. They're sitting in comfortable shirts at 70 °F, while we're maintaining 60 °F down at ice level."

"It's a living, breathing facility that runs 24 hours, that is constantly going to grow," Dougherty added. "I think personally it's going to be the destination place on the east coast in the coming years."

Audiences seem to agree. Bon Jovi rocked The Rock in October and November, 2007, with a ten-night stand that became the year's number-one grossing concert in North America. Just five months later, in March 2008, The Rock welcomed its one millionth fan.

Smooth as ice.

Adjusting for variables

The state-of-the-art systems at Prudential Center include many variable frequency motor drives (VFDs) on air handlers, pumps and chillers. VFDs are efficient and increasingly common, but have their own peculiarities. For one, the noisy synthetic wave forms they produce are impossible for a standard multimeter to measure. So Steve Backman, chief electrician at Prudential Center, tried the Fluke 87V True-rms Industrial Digital Multimeter, which has a built-in low-pass filter to clean up and accurately measure VFD outputs.

"Frequency drives are a little more work for the control guys," said chief engineer Tim Dougherty. "They have some issues. There's a lot of parameters they have to set."

Another variable at The Rock is voltage. Voltage runs high—490 V to 502 V instead of 480 V, and 126 V to 128 V on nominal 120 V circuits. "The voltage in the building is high, I know it's high, so there have to be some adjustments made," Backman said.

"The meter is great," Backman said. "Its compact size helps us get in and out of tight places—it's been a pleasure to work with. It's very accurate in measuring the frequency. I like the accuracy of the 87V. It's easy to get around with, it's durable. It takes a beating."

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