A Unique Way to Service Wind Generators

Servicing wind generators with an exterior basket/elevator system allows for more freedom of movement and increases safety.

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The tsunami that hit Japan two years ago caused a tremendous amount of damage and loss of life. The resulting catastrophe at the Fukushima Daiichi Nuclear Power Plant caused a 20 km area around the plant to be uninhabitable and radioactivity will be present in the area for many years to come. After the earthquake, all the nuclear power plants in Japan were taken offline and still remain there today pending new safety regulations that will take effect this year. Since the Fukushima incident, there has been a strong push by much of the Japanese population to promote traditional and alternative energy sources. One of the growing alternatives for electrical power generation is wind power. After the 2011 earthquake, it was noted that none of Japan's commercial wind turbines failed, even the Kamishu offshore wind farm that was directly hit by the tsunami.

Large wind generators are now present in most parts of the world. These wind generators require occasional maintenance and repairs. Wind generators require periodic cleaning and painting of the wind turbine tower and inspection and repair work to the blades. The height of these towers can be as tall as 300 ft with blade diameters around 200 ft. Obviously, climbing to this height for maintenance and/or repair is no easy task, not to mention it can be very dangerous. In the US, the exterior of many of these tall wind turbines are serviced by employees on wires ropes. Now, a Japanese company, Sakurai, has developed a new way to service these giant wind generators.

Currently, maintenance personnel travel up the inside of the support tower in a cramped space and then rappel from the top down to the exterior of the tower, but this new system attaches to the exterior of almost any tower. First, an exterior ladder is constructed and bolted to the tower frame. Then, a centralized steel rack system is installed. This system is installed one section at a time from the ground up, eliminating the need for a mobile crane. This feature is especially important for wind turbines at sea.

To drive the basket/elevator up and down the rack, a motor and worm drive gearbox is used. The output of the worm drive gearbox is attached to a pinion gear. Because of the high reduction in the worm gear, the system is inherently self-locking, but to assist in braking, an Ogura spring-applied brake, model SNB-1.2K, is used on the worm gear throughshaft. As an additional safety precaution, an Ogura spring-applied brake, model RNB-10K, is mounted directly on the stopping disc/pinion to hold the elevator in place.

The Ogura spring-applied brake, model SNB-1.2K, has a static torque rating of around 9 ft lb. The brake is mounted on the input shaft, (opposite side) of the worm gear reducer. The SNB brake is designed for both stopping and holding. When no current/voltage is applied to the brake, a series of springs push against an internal pressure plate squeezing the friction disc between the inner pressure plate and the outer cover place. This frictional clamping force is transferred to the hub, which is mounted to the shaft of the reducer. When the brake is required to release, voltage/current is applied to the coil,-creating a magnetic field. This magnetic field pulls the pressure plate compressing the springs, which releases the clamping force to the friction disc by creating an air gap allowing the brake, hub, and friction disc to turn freely. The power off brake is considered engaged when no power is applied, which is why it is considered a safety brake.

Support bracket attached to tower with rack rail in place.

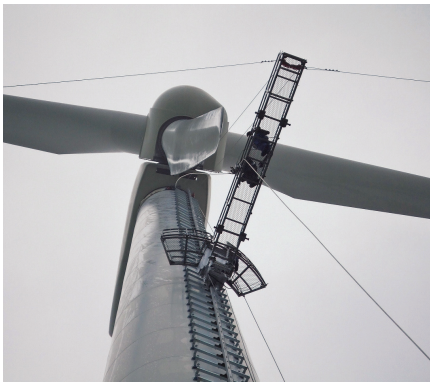
The Ogura SNB series offers a relatively thin profile, which allows for an overall

compact package for the elevator drive mechanism. Use of wear-resistant friction material provides extended operational life. Since the brakes are spring set, they deliver a fast response time. The SNB-1.2K also has three tapped holes that can be used to release the brake in case of a power failure. This would be used in an emergency condition to manually release the brake in case of an emergency.

The Ogura RNB-10K spring-applied brake, rated at 74 ft lb is designed for holding only. Once the worm drive and the Ogura SNB-1.2K stopping brake have the elevator in its set position, the RNB-

Side view of elevator with inspection basket lowered.

10K is engaged as an additional service brake. The RNB-10K is attached to the output of the gearbox and is located next to the pinion gear. This RNB brake was designed in case of a catastrophic failure within the worm drive reducer. So, if the worm drive was to fail, the elevator would not freefall and the RNB-10 would hold it in place.



Bottom view of elevator with inspection basket lowered.

SNB RNB brakes.

The Ogura RNB-10K operates identically to the SNB series with the exception that it is designed for holding only. Since it is used for holding only and does not require surface area to dissipate the heat of a stopping brake, the RNB is smaller than an equivalent torque SNB brake. Like the SNB brakes, the RNB series is also designed for fast response. Also like the SNB, it has release holes so the brake can be disengaged in case of an emergency.

The Sakurai maintenance elevator is lightweight and can be easily installed. Since installation does not require large equipment, such as cranes, there is a low installation cost. The total cost of this system can be up to 30 percent less than other companies' products using a basket type maintenance system sustained by wire ropes. Also, since personnel are completely supported in the elevator/basket, they can be moved quite effectively in case of injury or illness versus hanging from a wire rope. The basket/elevator can also be used to transport tools and parts as needed. These lightweight support baskets can also be moved from installation to installation fairly quickly and easily. This is particularly helpful in rugged, mountainous terrain where it may be impractical, or even impossible, to move large cranes to and from the windmill site.

The exterior basket/elevator system allows for more freedom of movement since it is on the exterior versus the interior of the tower. It also reduces worker fatigue and aids with safety, since it eliminates the physical exertion of climbing the ladder.

In the future, many new wind generators will be built in Japan. This year, a floating offshore wind turbine was tested about 1 km off an exterior island near Nagasaki. This was the first of its kind tested in Japan. If the test is completed successfully, up to 80 floating wind turbines will be completed off of Fukushima by 2020. The total capacity of the Fukushima offshore wind power project is projected to be around 1 gigawatt.