



Baldor Is Redefining the Future of Cooling Tower Performance

WITH INNOVATIVE
'GREEN' MOTOR
AND DRIVE TECHNOLOGY

For the past 20 years, Rod Applegate, the owner and president of Tower Engineering, Inc. of Fort Worth, Texas, has been searching for a better method of driving fans in cooling towers. He says he has finally found what he's been looking for in Baldor's new RPM AC® Direct Drive Cooling Tower Motor controlled by a Baldor VS1 Cooling Tower Drive.



Since 1986, Applegate’s company has been designing and installing high-quality cooling towers for the large institutional market, including hospitals, universities and airports. They all use an air conditioning system that requires a cooling tower to exchange heat and return cooled water back to the chiller.

These towers use large high inertia fans to pull air over a water soaked media to cool the water as part of the process. The

most common method for driving the fan in modern cooling towers has been a right-angle gear reducer, drive shaft and disc coupling arrangement, along with a standard foot mounted AC motor.

“I have always wanted to get rid of these gearboxes and all of the other moving parts,” says Applegate. “Misalignment, excessive vibration and noise are all inherent problems with this system. With the high speeds, the gearboxes generate

too much heat, and the seals and bearings can have very short lives. There are just too many things that can go wrong.”

There is also a significant maintenance issue for the owner. “Keeping up with regular oil changes of the gearbox and inspections of the flexible elements are critical,” says Applegate. “Ignoring either of these two can, and has, resulted in the catastrophic failure of equipment.”



The Baldor•Reliance® RPM AC® Cooling Tower Direct Drive Motor is designed exclusively for the cooling tower industry. This motor combines the technologies of the power-dense, laminated frame RPM AC motor with high performance, permanent magnet salient pole rotor designs. Combining this high torque industrial motor, with Baldor's VS1CTD adjustable frequency drive, results in a system that is quiet, energy efficient and easy to maintain.

Gearboxes are also prone to oil leakage around the high-speed input shaft, contaminating the tower cooling water.

Turning an Idea into New Technology

A couple of years ago, when a Dodge® engineer called on Tower Engineering to discuss gearboxes, Applegate explained, in no uncertain terms, that he didn't need another gearbox. What he needed was a direct drive fan motor.

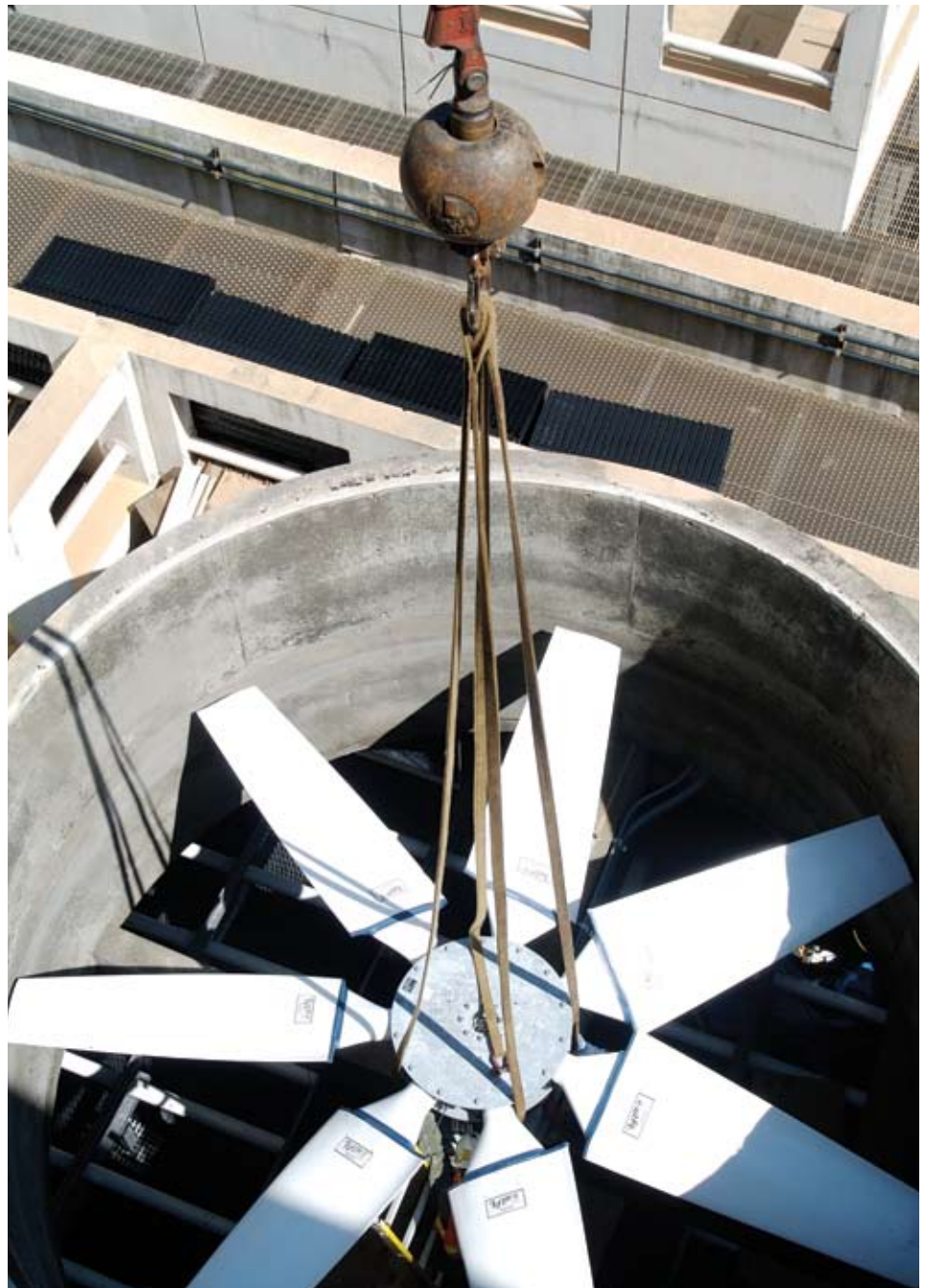
“To his everlasting credit, this engineer took the message back to the company, where it was determined that this was a project they would take on,” says Applegate. “In subsequent meetings at Baldor’s research and development lab, I was able to share with a group of engineers all the things that the cooling tower industry was looking for in a product. Once all the parameters were set, they went to work.”

In the meantime, Applegate had a patent pending on a cooling tower motor of his own, but he soon recognized that his design was not the way to go. “I am not a motor manufacturer, and frankly I could see that the Baldor design was going to be far superior. So, now I have a nice patent on display in my office, and that’s exactly where it’s going to stay.”

The result of the research and development is the Baldor•Reliance® RPM AC® Cooling Tower Direct Drive Motor, which features a power-dense, laminated steel, finned-frame construction. A proprietary Permanent Magnet Rotor (PMR) design using high-flux magnets allows the motor to be manufactured in a compact form, similar to the gearbox it replaces.

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Rod Applegate, owner and president of Tower Engineering, Inc. describes the Baldor•Reliance RPM AC Cooling Tower Motor as a revolutionary product. He says the Baldor engineers were smart enough to create a low profile motor design that fits in the same space and mounting footprint as the gearbox. “It’s so simple; it’s almost just a drop-in replacement,” says Applegate.

The combination of these innovative technologies has allowed the company to build a high torque, low profile motor, with the fan mounted directly on the motor shaft. It’s a synchronous machine that runs at precise speeds without slip in combination with a Baldor Permanent Magnet Cooling Tower Drive.

With Baldor’s release of the new cooling tower motor, Applegate says he finally has

the solution he has long been searching for. He describes it as a product that neatly sidesteps all of the issues of a traditional system. “If you don’t mind the phrase, I think it’s a simple and elegant solution,” says Applegate. “It’s elegant in the sense that you have traded all of the components for one moving part.”

NEW COOLING TOWER TECHNOLOGY HELPS EMORY UNIVERSITY ACHIEVE GREEN ENERGY SAVINGS

The timing of Baldor's launch of the RPM AC Cooling Tower Direct Drive Motor couldn't have been better for Emory University of Atlanta, GA. The university was beginning a project to replace two cooling tower units that had been in service since 1988. These two towers are part of a system that provides air conditioning to classrooms and offices in seven buildings on campus, including the new Claudia Nance Rollins School of Public Health.

Rob Manchester with Emory's Engineering Services is the mechanical engineer in charge of the project. He says he learned about the new technology from Tower Engineering, a company the University has been doing business with since 1992. Tower Engineering had just finished a cooling tower retrofit at Clemson University of Clemson, SC, and invited Manchester to visit the site and take a closer look at the new direct drive technology.

Tower Engineering was confident that Baldor's cooling tower motor was the optimal solution for the Emory project. After learning more about this simplified drive train, Manchester agreed, and was ready to move forward with a solution that would help him eliminate costly maintenance and reduce energy consumption.

"We were eager to move away from the traditional gearing units because most of our cooling tower maintenance problems related to the gearbox," says Manchester. "It needed regular oil changes, and the drive shafts also required ongoing regular attention. It's been a burden for our maintenance staff because the units are suspended in the middle of the cooling tower, which makes them very difficult to reach. We wanted a solution that would remove all the maintenance issues."



By combining the power density of the RPM AC motor with the added advantages of permanent magnet rotor technology, Baldor has designed a motor, driven by a Baldor H2 drive, that is highly efficient. Manchester says the University has a goal to decrease energy usage by 25% by 2015, and adopting this new technology will help in that effort.

"We have seen the studies that show us that this technology will provide some fairly significant energy savings," says Manchester. "I'm excited about reducing the amount of energy we consume, and because the product is maintenance free, we'll achieve a cost savings on two fronts."

Being an early adopter of new technology can sometimes raise additional concerns, but as the project moved forward, Manchester had the opportunity to visit Baldor's Gainesville, GA, motor plant and actually see his two motors being built.

"I have to admit that I felt much better embracing this new product technology after visiting the plant and seeing how these motors are manufactured," says Manchester. "I also feel very good about Baldor's involvement and their commitment in making sure this project goes well for us. I know I can talk directly with engineers who will be willing to help me if I have questions, and it makes me feel confident about adopting the Baldor solution, because I know I can count on their support."



Eliminating many of the components of the right-angle geared system, the Baldor•Reliance RPM AC Cooling Tower Direct Drive Motor is available in either flange mount or foot mount. The flange mount units are designed to be interchangeable with many popular gearbox bolt hole mounting configurations, making it an ideal solution for cooling tower retrofit applications.

A Greener Technology

Eliminating the troublesome gearbox maintenance issues with a simplified direct-drive motor is just the beginning. The Permanent Magnet Motor and Drive package provides high system efficiency. The variable speed control allows the tower to operate at optimum performance, which results in a considerable amount of energy being saved.

The energy efficiency story of the Baldor package is one that Applegate is eager to tell. “This is an important discussion to have in a time when everyone is concerned about reducing the amount of energy they consume,” says Applegate. “When gearboxes run at these high speeds, they generate a lot of heat, and that’s energy being lost. Based on the test data, we anticipate that the Baldor solution is 13% more efficient than a conventional drive train.”

The motors also run quieter, and the reduction in noise level is important, especially in towers that are located near “people-dense” buildings. In addition, by replacing the gearbox, the potential for environmental contamination is eliminated.

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Rod Applegate, owner and president, Tower Engineering, Inc.

The Solution for the 21st Century

Applegate describes the Baldor•Reliance Cooling Tower Motor as a revolutionary product but predicts that five years from now this solution will be the norm.

His company is already installing these motors in new cooling tower construction. He also believes this is an ideal solution for existing cooling towers.

“We will be doing as many retrofits as we can because they’re just so darn easy,” says Applegate. “The Baldor engineers were smart enough to create a low profile motor design that fits in the same space and mounting footprint as the gearbox. It’s so simple; it’s almost just a drop-in replacement.”

Over the past 20 years, Applegate has seen potential cooling tower fan drive solutions come and go, with none working any better than the gearbox drive train design. But this time he’s convinced he’s found a superior performing, user friendly and green solution.

“I am confident that this is a real and permanent solution for the industry,” says Applegate. “My confidence was strengthened after meeting and getting to know the engineers who designed and worked on the project. I was constantly blown away by their intelligence. I’ve also visited the plant and watched the product being manufactured. This is a company that will stand behind the product, and that’s why I know it will be a success.”

These new and innovative products are being built in Baldor’s Gainesville, GA, motor plant and Fort Smith, AR, drives center. Baldor expects this new technology to transform the traditional cooling tower fan motor and gearbox design to this new high-efficiency “green” direct-drive motor and control solution in the near future.



Designed specifically for the cooling tower industry, Baldor’s VS1CTD controls provide optimal variable speed performance that runs quieter with reduced energy consumption. The drive utilizes unique sensorless algorithms to accomplish smooth, soft-start operation, reducing stress on the system and extending life. Baldor VS1CTD controls are easy to set up because critical motor operational parameters have already been integrated into the firmware, eliminating the need to tune the control to the motor prior to operation. In addition, the drive supports multiple protocols so it can communicate seamlessly with most building automation systems.



A traditional cooling tower fan drive features a right-angle gearbox mounted under the fan powered by a drive shaft attached to an induction motor. Gearbox failures, oil leaks, failed drive shafts, misaligned drive shafts and excessive vibration and noise are all significant problems related to this drive system.