BALDOR • RELIANCE

# RPM AC™ Cooling Tower Direct Drive Motor & VS1CTD Variable Speed Control System

## Improved System Reliability, System Efficiency and Reduced Noise

Improvements in system reliability, system efficiency and reduced noise are now possible with the introduction of new motor and drive technology applied to cooling tower applications. The same electric motor and control technology that is being used to power today's most sophisticated hybrid vehicles is now being adapted to run cooling tower applications. Advances in motor power density using laminated steel finned frame construction combined with high flux strength permanent magnet salient pole rotor technology results in a high torque, slow speed, low profile motor that is mounted directly to the fan and operates at variable speed to maximize system efficiency. Permanent Magnet Rotor (PMR) construction using high flux strength Neodymium Iron Boron (NdFeB) magnets allows the motor to be manufactured in a compact form factor. The same basic motor design requirements for a hybrid vehicle: high torque, efficient, low weight, reliable, quiet and highly compact apply to the cooling tower application as well.

## Conventional Fan Drive

The most common solution for driving the fan in modern cooling towers utilizes an induction motor, driveshaft, disc couplings, guards, and gearbox arrangement as shown in Figure 1.

Typically this motor is a standard NEMA induction motor either EPAct or premium efficient. For improved system efficiency, two speed motors have been applied for use when full fan speed is not required due to decreased wet bulb temperatures. Two speed motors do provide some energy savings, but still must be cycled on and off to maintain the desired water temperature. This cycling involves many "across the line" starts drawing high amps and placing unnecessary strain on the mechanical and electrical components of the drive train system. While providing some flexibility in the tower control logic, two speed motors are not optimal when it comes to maximizing energy savings during times of reduced heat load on the system.

Historically, the mechanical components of the fan drive, specifically the right angle gearbox, have been the largest maintenance issue for cooling tower installations. Gearbox failures, oil leaks, failed drive shafts, misaligned drive shafts and excessive vibration are all significant problems related to this drive system.

**Figure 1: Gearbox mounted under fan**

## Direct Drive Motor

The Baldor RPM AC Cooling Tower Direct Drive motor is a motor designed exclusively for the cooling tower industry. The RPM AC product is a very power dense industrial motor with proven reliability in the most demanding industrial applications including steel mill, paper mill and drill rig applications. The Cooling Tower version of this motor utilizes interior permanent magnet rotor technology and is designed to be mechanically interchangeable with many existing cooling tower gearbox designs. The fan mounts directly to the motor. This direct drive arrangement eliminates the entire gearbox and driveshaft torque transmission components.

The PM design is a synchronous machine that runs at precise speeds without slip in combination with a Baldor PM AC adjustable frequency drive which is also designed exclusively for the cooling tower applications.

In addition to being small and very compact this motor is also quiet and energy efficient (see Figure 2 below).

**Figure 2: Fan mounted to Motor**

BALDOR

## Variable Frequency Control – Optimized Performance

By slowing down the motor in a Variable Torque load (such as a fan), considerable energy can be saved. The entire cooling tower system must be designed for the "Worst Case" (or highest air flow) scenario. Typically, a cooling tower fan can run considerably slower than nominal RPM rating of the motor.

As the speed of the motor is decreased, the air flow drops in a corresponding linear fashion. So, for example, if the motor runs at only 70% Speed, the air flow is correspondingly reduced to 70% of maximum air flow (see Figure 3 below).

The Input Power to the motor varies with the cube of the motor speed. For example, if a motor is run at half-speed, the power consumed by the motor is 1/8 [i.e. $(1/2)^3$]. So, if the needed airflow can be achieved by running at half-speed, it is possible to save a large amount of energy (see Figure 4 below).

**Figure 3**

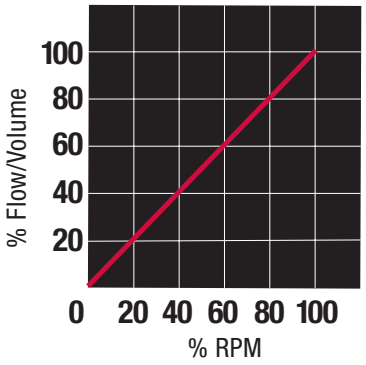
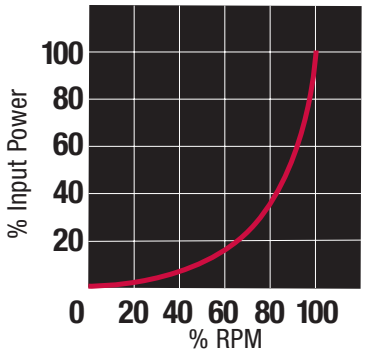



**Figure 4**




## Baldor V*S Drives and Permanent Magnet Control – Introducing VS1CTD Controls


Unlike a typical AC Induction Motor, a Permanent Magnet AC Motor cannot run across the line and requires a specially designed AC Drive for operation. To ease selection of the proper drive, Baldor has combined our new RPM AC Permanent Magnet Motors with our Baldor VS1CTD controls. These motor/drive packages are designed for Cooling Tower Applications and will function "out of the box" with very little tuning or commissioning required.

Baldor Permanent Magnet Drive/Motor Packages provide high system efficiency performance.

Baldor VS1CTD controls are easy to setup and operate due to the inclusion of a multi-language, graphic keypad. Setup screens lead you through the initial setup in plain English. Diagnostic messages keep you informed if anything is starting to go wrong and allow you to fix the problem before it gets out of hand. The Baldor VS1CTD keypad also has a Help Key. If you need help on a particular screen, simply press the Help Button for more information.

Baldor VS1CTD controls support all the common HVAC Communication Interfaces for Monitoring and Control including BACnet, Johnson Controls Metasys-N2, LonWorks and MODBUS-RTU.

## Maintenance Free, Easy Retrofit or New Installations

The RPM AC Direct Drive Cooling Tower is designed with the user in mind. The motor is designed to be in the air stream with shaft sealing protection to keep out water and contamination. The special end brackets and overall length profile are designed to be a direct interchangeable with many existing gearbox designs.

## Features and Benefits

- Increased system reliability, fewer components
- 3 year warranty
- Operation at optimal system efficiency point using variable speed control
- Energy efficient with high power factor for reduced energy consumption or increased cooling capacity at equivalent power consumption
- Reduced overall noise levels
- Easy retrofit

## Cost Effective

Compared to traditional fixed speed installations the cost of this V*S (Variable Speed) solution is very competitive. When combined with the eliminated maintenance costs, increased energy saving the system will more than pay for itself.

## More Information

For more information on the availability and performance of the new RPM AC Direct Drive Cooling Tower motor and companion Baldor V*S drive contact your local Baldor Electric sales office.


**Baldor Electric Company**
P.O. Box 2400 • Fort Smith, AR 72902-2400 U.S.A.
Phone (479) 646-4711 • Fax (479) 648-5792 • International Fax (479) 648-5895 • www.baldor.com




FL476
Printed in U.S.A.
02/09 PRINTER? ?00