



Baldor Adjustable Speed Direct Drive Cooling Tower Motor and Drive System for Industrial Applications





Adjustable Speed Direct Drive Cooling Tower System

New Direct Drive Technology – Improves Reliability, Reduces Maintenance, Runs Quieter & Saves Energy

By combining the technologies of the field proven and power dense AC laminated frame RPM AC motor with high performance permanent magnet (PM) salient pole rotor designs and the matched performance of an adjustable speed drive, Baldor Electric can offer high torque direct drive motors for cooling tower applications with all the benefits of variable speed control and eliminating the cost and maintenance required for traditional gearbox or belted solutions. The fan couples directly to the motor and is controlled by a unique AC drive to provide optimal speed and cooling tower performance that runs quieter with reduced energy consumption. The drive is designed to accommodate the most common industrial communication protocols.

Direct Drive RPM AC Synchronous PM Motor Reduces Maintenance Cost

The RPM AC[™] synchronous PM motor uses laminated finned frame construction to provide a highly efficient power dense package with flange mounting dimensions that can replace the right angle gearbox and jack shaft installation in many conventional cooling towers. This same technology is offered in conventional, yet power dense, foot mounted designs that can replace the belt and sheave application where more vertical mounting space is available. Derived from one of the toughest motor platforms used in the most demanding industrial applications, the RPM AC motor is the right solution for operation inside the tower's hot and humid environment. The TEAO (totally enclosed air over) RPM AC cooling tower motor is designed for minimal maintenance. Bearings require lubrication only once per year. Water ingress along the shaft is prevented with the use of an Inpro/Seal[®] bearing isolator and a slinger. The electrical insulation system is manufactured using a VPI (vacuum pressure impregnation) process that ensures long motor life even in the most extreme environmental conditions. Condensation drains relieve any moisture that may collect inside the motor. No more changing gear oil, lubricating pillow block bearings or changing out belts.

ABB ACS880 Cooling Tower Drive*

The ABB ACS880 Cooling Tower Drive utilizes our Matched Performance philosophy to ensure trouble-free operation with the Baldor RPMAC Permanent Magnet Cooling Tower Motor Family. The drive also provides custom features for the Cooling Tower Industry including Trickle Current Motor Heating, Locked Motor Rotor functionality to prevent wind-milling when not enabled, De-ice Mode, Accelerometer Feedback and RTD Temperature Feedback. Additionally, much complexity is reduced in the Cooling Tower Drive by removing all of the General Purpose Drive Parameters and only providing the necessary Cooling Tower Drive Parameters, allowing for easy configuration and start-up. The ABB Cooling Tower Drive also provides a Quick Start Assistant specifically for cooling tower applications making start-up simple and straight-forward.

Field Tested Reliability

After extensive Lab testing at Baldor's facility, motor and drive systems have been installed and field tested for extended periods of time. One system is running under a controlled environment on one of two identical cooling towers at Clemson University. Both towers were instrumented and the traditional geared system was evaluated against the Baldor CT Direct Drive Solution. Each tower had the same 5 blade, 18 foot diameter fan, with pitch and tip clearance adjusted to identical settings. Performance results, which were verified by a third party reduced losses in the system by approximately 50% and provided a measured input kW power savings of 11.8% compared to a traditional geared system, with high speed noise reduction from 82.3 dBA to 74.4 dBA and reduced vibration.

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*ACS880 Cooling Tower Drive specified with "+N5350" variant code.







RPM AC Direct Drive Cooling Tower Features & Benefits

Direct Drive Motor

- Eliminates the need for a gearbox, jack shaft, pillow block bearings and couplings
- Reduces maintenance and provides improved reliability
- Eliminates cooling water contamination by eliminating gearbox oil and leakage
- Reduces power consumption
- Results in increased safety due to removal of rotating equipment.
- Water-tight motor design operates in the air stream
- Eliminates the alignment of mechanical components for quicker installation, reduced installation costs and increased system efficiency

Bearings and Seals

- Oversized to maintain longer bearing life exceeding L-10 100,000 hours
- Grease lubricated for long life
- Handles fan loads with improved reliability
- Proven Inpro/Seal® bearing isolator with slinger umbrella over seal
- Only one ingress point
- Insulated opposite drive end bearing on FL440 and FL5800

Adjustable Speed Control

- Designed specifically for the Cooling Tower Industry and can be set at the optimum speed point (+N5350)
- Sensorless Permanent Magnet motor control operates without an encoder or resolver
- Trickle heating eliminates need for motor space heaters
- Guaranteed Compatibility due to the Matched Performance of the motor and drive
- Allows for a soft start (controlled ramp)
- \bullet Saves energy and reduces mechanical stress on the system 30 60%
- Improves system reliability and extends life
- Reduces noise
- Trickle current for braking prevents fan windmilling when not in operation
- System resonance speeds can be bypassed
- +P934 Drive Care Warranty provides a 5 Year Warranty on the Drive with a Preventative Maintenance on the Drive at 3 Years.

Communication Protocols

When system automation control and monitoring is a requirement for your cooling tower operation, the ABB Cooling Tower Drive easily communicates with all the Industrial Communication Networks including Ethernet/IP, DeviceNet, Profibus-DP, CANopen, MODBUS/TCP, PROFINET, MODBUS-RTU and EtherCAT.

Retrofit or New Tower Designs

RPM AC cooling tower motors are available in either flange mount or foot mount designs for mounting in the air stream. The flange mount units are designed to be interchangeable with many popular gearbox bolt hole mounting configurations. Shaft height, diameter and flange mounting dimensions can be directly interchangeable with some existing cooling tower gearbox designs. Higher motor torque ratings are available using taller motors when space is available. In addition, traditional foot mount construction is available. Both flange and foot mount designs are available in a wide torque range in frame sizes FL250, FL280, FL320, FL360, FL400, FL440 and FL5800.

Baldor's Direct Drive motor eliminates many components of a right angle geared system.



Conventional Tower Design



New Direct Drive Tower Design



A typical conventional fan drive arrangement of a gearbox mounted under the fan.

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RPM AC Cooling Tower Motor and Drive Specifications

Motor Specifications					
Motor Frame Size	Max. Torque (lb.ft.)	Minimum required Air velocity (ft./min.)	Approx. Wgt. (lb.)	*Est. Motor Height "M" (in.)	Catalog Number
FL2554	90		360	14	Custom
FL2562	130	750	425	16	Custom
FL2570	175	/ 50	500	18	Custom
FL2578	220		570	20	Custom
FL2873	290		590	18	Custom
FL2882	370	750	690	20	Custom
FL2890	440	- /50	775	22	Custom
FL2898	515		860	24	Custom
FL3203	715	750	*	*	Custom
FL3213	850	/50	*	*	Custom
FL3698	1055	750	1595	25	Custom
FL3614	1375	/ 50	1870	29	Custom
FL4034	1650		2160	29	Custom
FL4046	1940	750	2420	32	Custom
FL4058	2230		2680	35	Custom
FL4429	3040	750	3145	31	Custom
FL4440	3480	730	3450	35	Custom
FL5818	3992		5500	39	Custom
FL5820	4622	_	5900	41	Custom
FL5822	5042	-	6300	53	Custom
FL5824	5672	-	6700	45	Custom
FL5826	6302	250	7100	47	Custom
FL5828	6723	-	7500	49	Custom
FL5830	7353	-	7900	51	Custom
FL5832	7983	-	8300	53	Custom

*Available Fourth Quarter 2014

Select motor frame size as determined by required fan torque.

Fan Torque= (HP * 5252) / Fan Speed.

Use existing motor HP and fan speed to calculate required torque.

RPM AC Cooling Tower Motor and Drive Specifications

	Drive Specifications						
HP	Туре	Full Load Amps	Frame	Catalog Number			
	,	240Vac Dr	ives				
7.5	Industrial	23.1	R2	ACS880-01-24A3-2+N5350+P934			
10	Industrial	29.3	R3	ACS880-01-031A-2+N5350+P934			
15	Industrial	44.0	R4	ACS880-01-046A-2+N5350+P934			
20	Industrial	58.0	R4	ACS880-01-061A-2+N5350+P934			
25	Industrial	71.0	R5	ACS880-01-075A-2+N5350+P934			
30	Industrial	83.0	R5	ACS880-01-087A-2+N5350+P934			
40	Industrial	109.0	R6	ACS880-01-115A-2+N5350+P934			
50	Industrial	138.0	R6	ACS880-01-145A-2+N5350+P934			
60	Industrial	162.0	R7	ACS880-01-170A-2+N5350+P934			
75	Industrial	196.0	R7	ACS880-01-206A-2+N5350+P934			
100	Industrial	260.0	R8	ACS880-01-274A-2+N5350+P934			
		480Vac Dr	ives				
7.5	Industrial	11.0	R1	ACS880-01-11A0-5+N5350+P934			
10	Industrial	14.0	R2	ACS880-01-014A-5+N5350+P934			
15	Industrial	21.0	R2	ACS880-01-021A-5+N5350+P934			
20	Industrial	27.0	R3	ACS880-01-027A-5+N5350+P934			
25	Industrial	34.0	R3	ACS880-01-034A-5+N5350+P934			
30	Industrial	40.0	R4	ACS880-01-040A-5+N5350+P934			
40	Industrial	52.0	R4	ACS880-01-052A-5+N5350+P934			
50	Industrial	65.0	R5	ACS880-01-065A-5+N5350+P934			
60	Industrial	77.0	R5	ACS880-01-077A-5+N5350+P934			
75	Industrial	96.0	R6	ACS880-01-096A-5+N5350+P934			
100	Industrial	124.0	R6	ACS880-01-124A-5+N5350+P934			
125	Industrial	156.0	R7	ACS880-01-156A-5+N5350+P934			
150	Industrial	180.0	R7	ACS880-01-180A-5+N5350+P934			
200	Industrial	240.0	R8	ACS880-01-240A-5+N5350+P934			
250	Industrial	302.0	R9	ACS880-01-302A-5+N5350+P934			
	,	600Vac Dr	ives				
7.5	Industrial	9.0	R5	ACS880-01-07A3-7+N5350+P934			
10	Industrial	11.0	R5	ACS880-01-09A8-7+N5350+P934			
15	Industrial	17.0	R5	ACS880-01-14A2-7+N5350+P934			
20	Industrial	22.0	R5	ACS880-01-018A-7+N5350+P934			
25	Industrial	27.0	B5	AC\$880-01-022A-7+N5350+P934			
	Industrial	32.0	B5	AC\$880-01-026A-7+N5350+P934			
40	Industrial	41.0	B5	AC\$880-01-035A-7+N5350+P934			
50	Industrial	52.0	B5	AC\$880-01-042A-7+N5350+P934			
60	Industrial	62.0	B6	AC\$880-01-061A-7+N5350+P934			
75	Industrial	77.0	B6	ΔCS880-01-084Δ-7+N5350+P934			
100	Industrial	99.0	B7	ΔCS880-01-098Δ-7+N5350+P934			
105	Industrial	125.0	R7				
150	Industrial	1// 0		ΔΓ2880_01_1/20.7 - Ν5250 - D024			
200	Industrial	102.0					
200	Industrial	192.0					
250	industrial	242.0	Г Кр	AUSOON-01-210A-7+N5350+P934			

Adjustable Speed Drive Cooling Tower Dimensions Select drive rating and frame size based upon motor full load amps





Frame	Product Dimensions – inches (mm)								
Size	Height (in)	Height (mm)	Width (in)	Width (mm)	Depth (in)	Depth (mm)	Weight (lb)	Weight (kg)	
R1	16.0	405	6.1	155	8.9	226	13.2	6	
R2	16.0	405	6.1	155	9.8	249	17.6	8	
R3	18.5	471	6.7	182	10.3	261	22.0	10	
R4	22.6	573	8.0	203	10.8	274	40.8	18.5	
R5	28.7	730	8.0	203	10.8	274	50.7	23	
R6	28.6	726	9.8	251	14.1	357	99.2	45	
R7	34.6	880	11.2	284	14.4	365	121.3	55	
R8	37.9	963	11.8	300	15.2	386	154.3	70	
R9	37.6	955	15.0	380	16.3	413	216.0	98	

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RPM AC Cooling Tower Motor Dimensions

Select motor frame size based upon required fan torque





Motor Frame Size	* Typical Shaft Length	Usable Shaft Length	* Typical Shaft Dia. "U"	"X" Min. Bolt Circle (in.)	"Y" Max. Bolt Circle (in.)	Number of holes per bolt circle
FL25XX	8.5	6.94	1.999	14	16	4
FL28XX	8.0, 8.5	5.75, 6.25	2.374	15-16 Slot	20	4
**FL32XX	Future	Future	Future	Future	Future	Future
FL36XX	8.5, 9.0, 9.5	6.38, 6.88, 7.38	2.999	20, 22	25***	4
FL40XX	8.5, 9.0, 9.5	6.38, 6.88, 7.38	2.999	22	25	4
FL44XX	8.5, 9.0, 9.5	6.38, 6.88, 7.38	2.999	22	25	4
FL58XX	12.0	6.88, 11.75	4.999	—	34	8

*Shaft length and diameter can vary by application requirements.

**Available Fourth Quarter 2014

***4 holes on three bolt circles.

Tapered shafts are also available. Typical taper is 1/2" per foot. Special non-standard shaft requirements must be defined on the order.

Motor Features

- Mounting pad standard on FL58XX Frame Motors
- Mounting pad optional on 440-Frame and smaller motors
- Thermostats one per phase normally closed
- Heavy build external coatings
- Proven Inpro/Seal[®] bearing isolator with slinger umbrella over seal (58XX-Frame Motors Only)
- Proven insulation system technology used in off-shore drilling applications
- Stator RTD standard on FL58XX Frame Motors
- Stator RTD optional on 440-Frame and smaller motors

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Cooling Tower Direct Drive Standard Panel Offering

Based on ACS880 + N5350 Cooling Tower Drives

Standard in all CTDD Panels:

- Matched Performance ACS880 + N5350 Cooling Tower Drive
- Enclosure Standard Features: NEMA 12 Enclosure Bottom Power Cabling Entry/Exit Filtered, Forced Air Enclosure Enclosure Heating for Anti-Condensation Earth Bond and Equipment Grounding Terminals Back of Door Schematic and Holder
- Input Fuses
- 100k AIC Short Circuit Rating
- 115Vac Control Transformer
- Space Heater Branch Circuit
- Door Mounted Drive Keypad
- Door Mounted Operators Hand/Auto Emergency Stop Drive Running Drive Fault
- Remote Wiring Terminal Strip Run Permissive Run Command Analog Reference T-Stat Connection including Isolation Relay Vibration Sensor Connection

CTDD Panel Options:

- Optional Enclosure Type NEMA 3R (+3R)
- Power Options Select one of the options below Fused Disconnect (+FD) Molded Case Circuit Breaker (+CB)
- Input Power Conditioning Package (+IP) Input Line Reactor Input Line TVSS
- Input Noise Immunity/Emission Reduction EMC/RFI Filter (+EF)
- Output Contactor Package (+OP) Output Isolation Contactor Motor Shorting Contactor
- Long Motor Runs Select one of the options below dv/dt Filter (+DF) Sine-Wave Filter (+SF)
- Motor Bearing Current Mitigation Common Mode Choke (+CM)
- Thermostat Options 360° T-lead shield landing (+TS)
- Fieldbus Options
 Ethernet FENA-11 (EIP, MB/TCP, ProfiNET) (+EC)
 Profibus-DP FPBA-01 (+PC)
 DeviceNet FDNA-01 (+DC)
 MODBUS-RTU FSCA-01 (+MC)
 CANopen FCAN-01 (+CC)
- Cooling Blower Branch Circuit (+BL)

V*S Control Provides Optimized Cooling Tower Performance and Energy Savings Even Under Low Load Conditions

By optimizing motor speed considerable energy can be saved. The entire cooling tower system must be designed for the "Worst Case" (or highest air flow) scenario. For optimum system performance the fan may need to operate at reduced speed.

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 50% speed, the air flow is correspondingly reduced to 50% of maximum air flow.

However, 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 12.5% or 1/8 [i.e. $(1/2)^3$] of the power consumed at full speed. So, if the needed airflow can be achieved by running at half-speed, it is possible to save a large amount of energy (see energy chart below).



Adjustable Speed Saves Energy





Another important aspect of the PM motor design versus a traditional induction motor is its ability to maintain high efficiency performance when operating under low load conditions which are typical for variable speed fan applications.

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Baldor Cooling Tower Motor RFQ

Company Name:	Project:	Project:			
Fan Diameter (ft.)	Air Flow (cfm)				
Fan Speed (RPM)	Ambient Temp				
Existing Motor Hp	Static Pr	essure (inches of H_20)			
Fan Shaft Hp (This is normally an odd number ex: 42.3 Hp based on operating conditions)	Air Dens	Air Density (lb/ft ³)			
Voltage Required	Fan mfq	n mfq P/N			
Height RestrictionsYES / NO	No. Fan I	Blades			
"A" inches	ee diagram - " <i>F</i>	\" dimension)			
Match Existing Bolt Hole Pattern? YES / NO					
If Yes, please give existing Bolt Hole Pattern					
Air Velocity in Region of Motor (ft/min)			1		
If retrofit		Fan Shaft Diameter (in.)	Keyway (in.)		
Gearbox Manufacturer		1.999" ± .0005"	1/2" x 1/4"		
Gearbox Model No		$2.374^{"} \pm .0005^{"}$	5/8" x 5/16"		
The Palder Solution requires a Palder CTPM VED		2.024 ± .0005 2.000" + .0005"	3/4" x 3/8"		
Approximate distance from materia VED leastion	Feet	Other Shaft Dia. Requirements			
Drive location: Control Room [] Outside: []					
6" from Motor/Gearbox Air Flow Air Flow Air Flow Generation Air Flow Generation Generati	B" C" "L1" sed shaft "L2 " d & tapped h	F			
Required information to quote properly Questions regarding above information Please contact your local Baldor District Office		BAT A MEMBER OF	IDOR THE ABB GROUP		

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Printed in U.S.A 2/14 Litho 10,000

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