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VARIABLE SPEED MOTORS

# Direct drive cooling tower motor and drive system

For industrial applications

**BALDOR • RELIANCE**







# New direct drive technology

Improves reliability, reduces maintenance, runs quieter and 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, ABB can offer high torque direct drive motors for cooling tower applications. The direct drive solution offers the benefits of variable speed control and eliminates the cost and maintenance required for traditional gearboxes 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-Reliance 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, 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-Reliance 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.

\*ACS880 cooling tower drive specified with "+N5350" variant code.



# RPM AC direct drive cooling tower

## Features and 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
- 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)
- 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.



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

# Optimized cooling tower performance

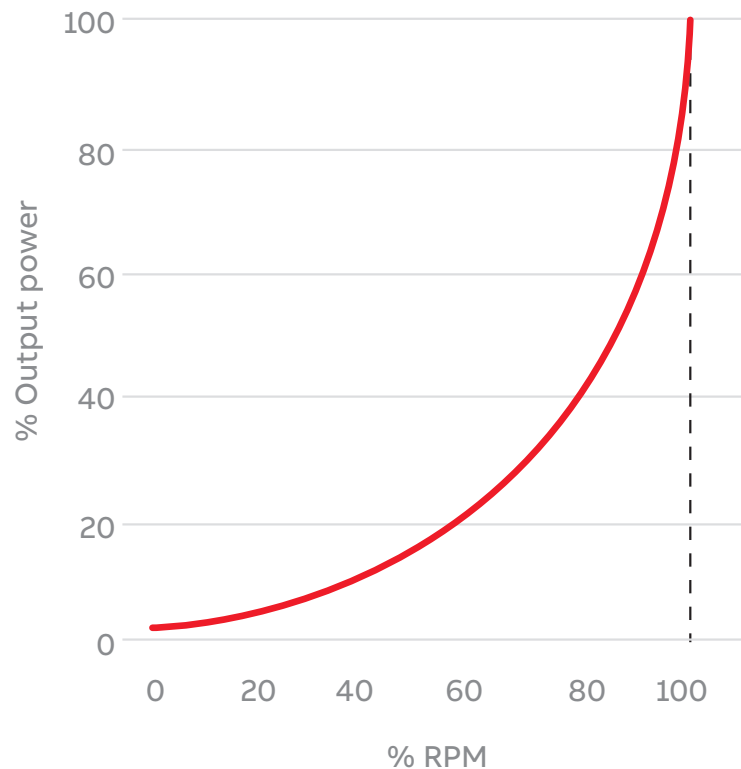
## Energy savings even under low load conditions

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.  $(\frac{1}{2})^3$ ] 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).

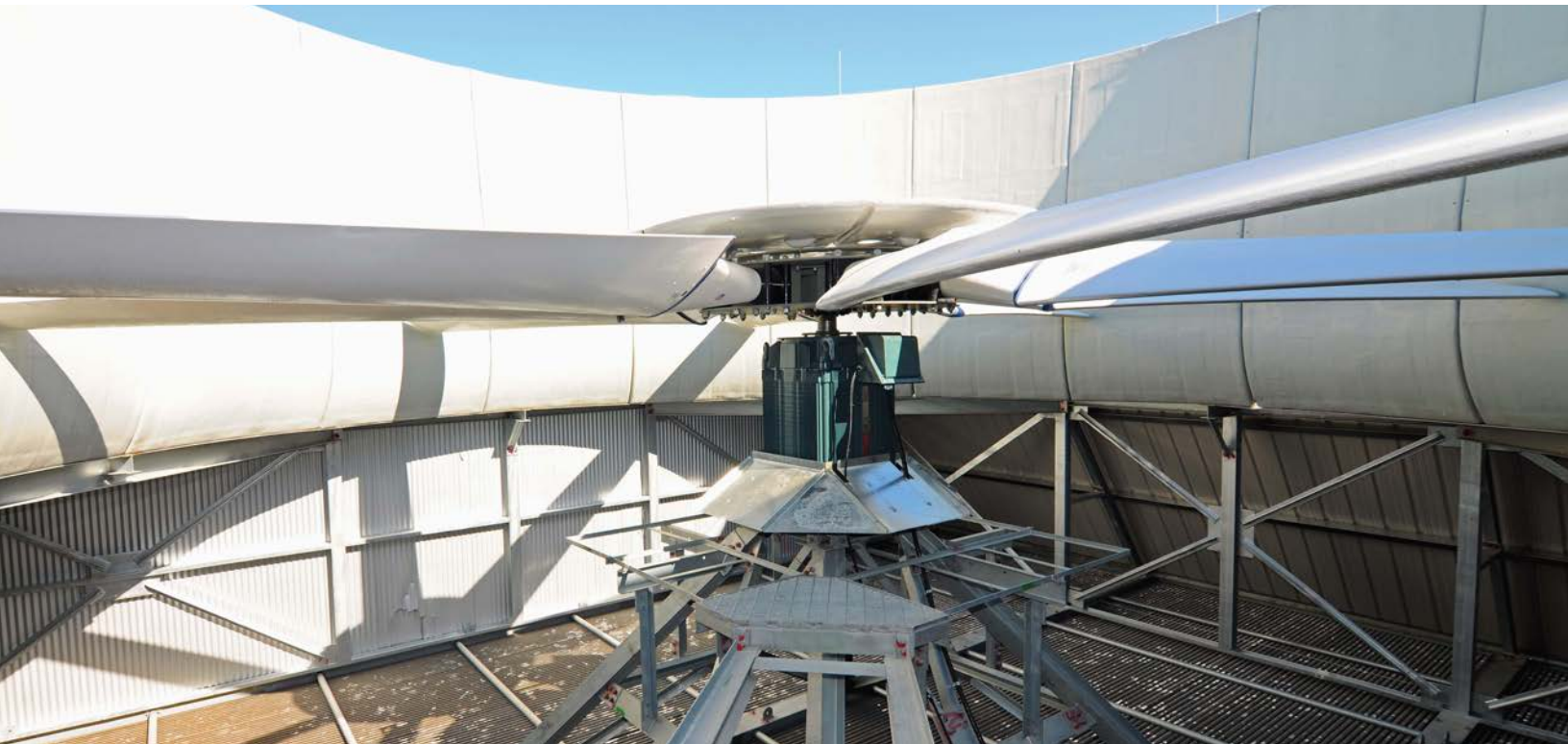
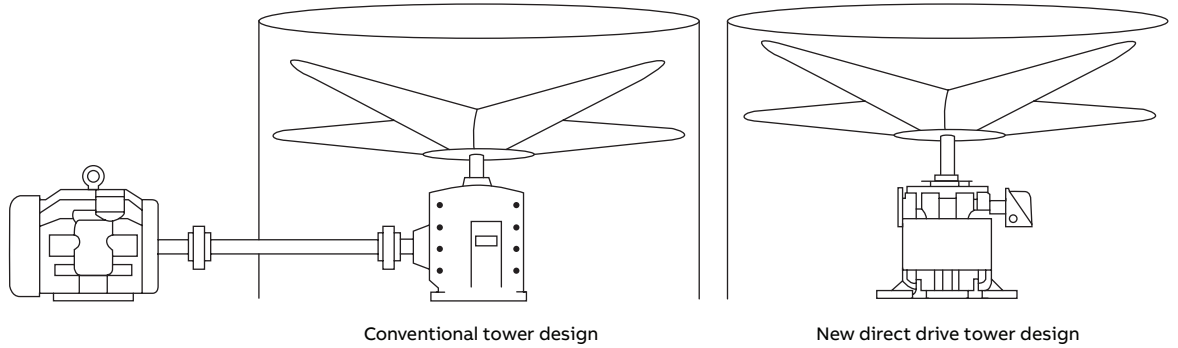
**Adjustable speed saves energy**



# Retrofit or new tower designs

A direct drive motor eliminates many components of a right angle geared system.

RPM AC Cooling tower motors are flange mount 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. Higher motor torque ratings are available using taller motors when space is available. Flange mount designs are available in a wide torque range in frame sizes FL250, FL280, FL320, FL360, FL400, FL440, and FL5800





# RPM AC cooling tower wizard

## Motor design and selection tool

### The RPM AC cooling tower wizard – Design tool

The RPM AC cooling tower wizard is a comprehensive motor and drive selection program that allows the user to specify as few as three parameters; (motor Hp, fan speed, air flow over the motor) and then calculate a direct drive motor and drive solution in either a stock offering or a custom design.

Additional features built in the wizard provide an annual cost of operation analysis estimation between a direct drive solution and a traditional/existing gearbox or belted application. The input data for this calculation is fully customizable to your current operating conditions to allow the most accurate cost savings estimation. Full performance data packets and dimensional drawings are also available through the wizard. To download your wizard just go on line to <https://www.baldor.com/brands/baldor-reliance/customer-resources/software-resources/cooling-tower-wizard-software>.

**CT RPM AC Cooling Tower Wizard**

File Settings Help

Rating: 40 HP Voltage: 460 V

Speed: 197 RPM Motor Ambient: 40 °C 104 F

Height: in Altitude: 3300 ft

Class: F rise Air Velocity: 750 ft/min

Class I, Div. 2, Groups A, B, C, D  
Class II, Div. 2, Groups F, G T3

Calculate Cost of Operation Performance Data

Custom Motor  Stock Motor

Parameter	Custom Motor	Stock Motor
Motor Catalog #		DDCTRPM3601
Frame Size	FL3614	FL3614
Current	47.0 Amps	59.9 Amps
Efficiency	90.7 %	90.7 %
Motor Height	28.43 in	28.43 in
Drive Catalog #	ACS880-01-052A-5	ACS880-01-065A-5
Drive Frame	R4	R5

ABB

# RPM AC cooling tower motor and drive

## Models

We have several stock models available that can fit your application requirements. These models can be selected through the RPM AC cooling tower wizard tool. The RPM AC cooling tower wizard is a comprehensive motor selection tool that allows the user to specify motor parameters.

Motors can be rerated to meet customer specifications or a custom motor can be ordered/specified.

### 460 volt DDCT motor specifications

Catalog number	Frame	Voltage	Max. torque (lb.ft.)	Minimum required air velocity over the motor (ft./min.)	Drawing number
DDCTRPM2501	FL2562	460	130	750	617549-003
DDCTRPM2502	FL2570	460	175	750	617549-004
DDCTRPM2503	FL2578	460	220	750	617549-005
DDCTRPM2801	FL2882	460	370	750	617557-003
DDCTRPM2802	FL2890	460	440	750	617557-004
DDCTRPM2803	FL2898	460	515	750	617557-005
DDCTRPM3201	FL3213	460	850	750	619668-004
DDCTRPM3601	FL3614	460	1375	750	619666-004
DDCTRPM4001	FL4034	460	1650	750	619664-004
DDCTRPM4002	FL4046	460	1940	750	619664-005
DDCTRPM4003	FL4058	460	2230	750	619664-006

### 400 volt DDCT motor specifications

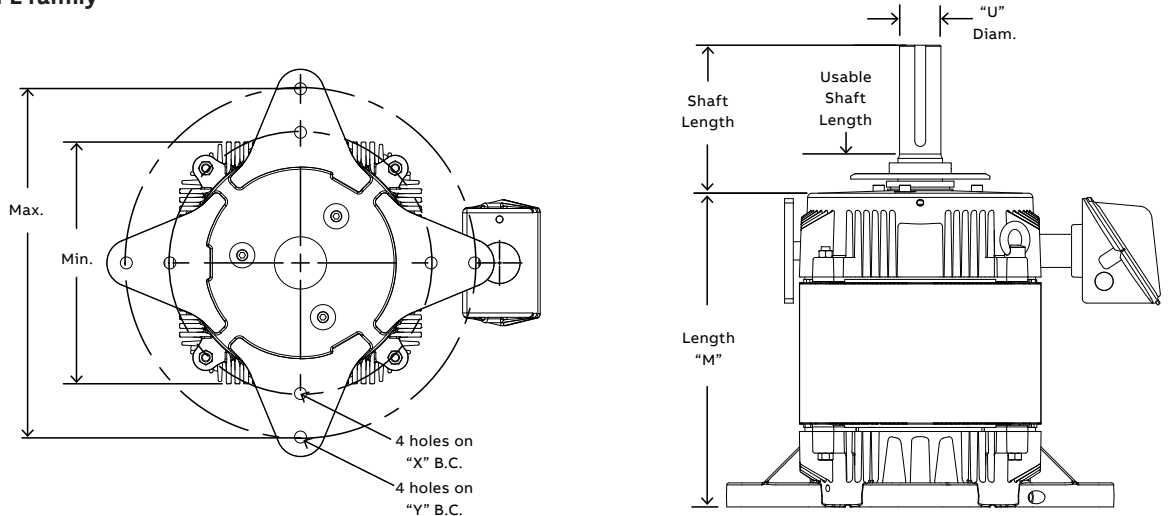
Catalog number	Frame	Voltage	Max. torque (Nm)	Minimum required air velocity over the motor (m/s)	Drawing number
DDCTRPM2504	FL2562	400	176	3.81	617549-503
DDCTRPM2505	FL2570	400	237	3.81	617549-504
DDCTRPM2506	FL2578	400	298	3.81	617549-505
DDCTRPM2804	FL2882	400	501	3.81	617557-503
DDCTRPM2805	FL2890	400	596	3.81	617557-504
DDCTRPM2806	FL2898	400	698	3.81	617557-505
DDCTRPM3202	FL3213	400	1152	3.81	619668-504
DDCTRPM3602	FL3614	400	1864	3.81	619666-504
DDCTRPM4004	FL4034	400	2237	3.81	619664-504
DDCTRPM4005	FL4046	400	2630	3.81	619664-505
DDCTRPM4006	FL4058	400	3023	3.81	619664-506

Re-rate stock motors are available  
 More ratings are available as custom configured motors.  
 These models are available from our industry leading distribution network

# RPM AC cooling tower motor

## Dimensions

### FL family



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	8.0, 8.5	5.88, 6.38	1.99, 2.37	16	20	4
**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.

\*\*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

# Adjustable speed drive cooling tower

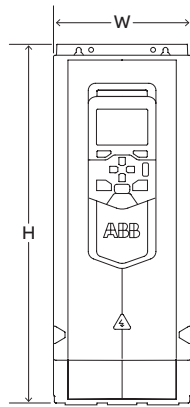
## Models

Drive specifications				
Hp	Type	Full load amps	Frame	Catalog number
<b>230 Vac drives (range 208 to 240 V)</b>				
7.5	Industrial	23.1	R2	ACS880-01-24A3-2+N5350
10	Industrial	29.3	R3	ACS880-01-031A-2+N5350
15	Industrial	44.0	R4	ACS880-01-046A-2+N5350
20	Industrial	58.0	R4	ACS880-01-061A-2+N5350
25	Industrial	71.0	R5	ACS880-01-075A-2+N5350
30	Industrial	83.0	R5	ACS880-01-087A-2+N5350
40	Industrial	109.0	R6	ACS880-01-115A-2+N5350
50	Industrial	138.0	R6	ACS880-01-145A-2+N5350
60	Industrial	162.0	R7	ACS880-01-170A-2+N5350
75	Industrial	196.0	R7	ACS880-01-206A-2+N5350
100	Industrial	260.0	R8	ACS880-01-274A-2+N5350
<b>460 Vac drives (range 380 to 500 V)</b>				
7.5	Industrial	11.0	R1	ACS880-01-11A0-5+N5350
10	Industrial	14.0	R2	ACS880-01-014A-5+N5350
15	Industrial	21.0	R2	ACS880-01-021A-5+N535+P934
20	Industrial	27.0	R3	ACS880-01-027A-5+N5350
25	Industrial	34.0	R3	ACS880-01-034A-5+N5350
30	Industrial	40.0	R4	ACS880-01-040A-5+N5350
40	Industrial	52.0	R4	ACS880-01-052A-5+N5350
50	Industrial	65.0	R5	ACS880-01-065A-5+N5350
60	Industrial	77.0	R5	ACS880-01-077A-5+N5350
75	Industrial	96.0	R6	ACS880-01-096A-5+N5350
100	Industrial	124.0	R6	ACS880-01-124A-5+N5350
125	Industrial	156.0	R7	ACS880-01-156A-5+N5350
150	Industrial	180.0	R7	ACS880-01-180A-5+N5350
200	Industrial	240.0	R8	ACS880-01-240A-5+N535+P934
250	Industrial	302.0	R9	ACS880-01-302A-5+N5350
<b>575 Vac drives (525 to 690 V)</b>				
7.5	Industrial	9.0	R5	ACS880-01-07A3-7+N5350
10	Industrial	11.0	R5	ACS880-01-09A8-7+N5350
15	Industrial	17.0	R5	ACS880-01-14A2-7+N5350
20	Industrial	22.0	R5	ACS880-01-018A-7+N5350
25	Industrial	27.0	R5	ACS880-01-022A-7+N5350
30	Industrial	32.0	R5	ACS880-01-026A-7+N5350
40	Industrial	41.0	R5	ACS880-01-035A-7+N5350
50	Industrial	52.0	R5	ACS880-01-042A-7+N5350
60	Industrial	62.0	R6	ACS880-01-061A-7+N5350
75	Industrial	77.0	R6	ACS880-01-084A-7+N5350
100	Industrial	99.0	R7	ACS880-01-098A-7+N5350
125	Industrial	125.0	R7	ACS880-01-119A-7+N5350
150	Industrial	144.0	R8	ACS880-01-142A-7+N5350
200	Industrial	192.0	R8	ACS880-01-174A-7+N5350
250	Industrial	242.0	R6	ACS880-01-210A-7+N5350

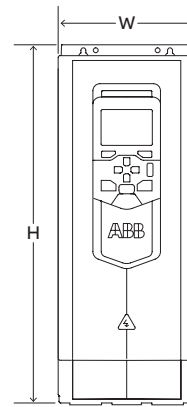
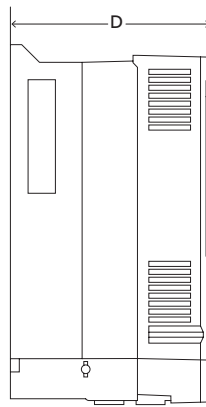
**400 Vac drives (range 380 to 415 V)**

HP	KW	Type	Full load amps	Frame	Catalog number
7.5	5.50	Industrial	12.9	R1	ACS880-01-12A6-3+N5350
10	7.50	Industrial	17	R2	ACS880-01-017A-3+N5350
15	11.00	Industrial	25	R2	ACS880-01-025A-3+N5350
20	15.00	Industrial	32	R3	ACS880-01-032A-3+N5350
25	18.50	Industrial	38	R3	ACS880-01-038A-3+N5350
30	22.00	Industrial	45	R4	ACS880-01-045A-3+N5350
40	30.00	Industrial	61	R4	ACS880-01-061A-3+N5350
50	37.00	Industrial	72	R5	ACS880-01-072A-3+N5350
60	45.00	Industrial	87	R5	ACS880-01-087A-3+N5350
75	55.00	Industrial	105	R6	ACS880-01-105A-3+N5350
100	75.00	Industrial	145	R6	ACS880-01-145A-3+N5350
125	90.00	Industrial	169	R7	ACS880-01-169A-3+N5350
150	110.00	Industrial	206	R7	ACS880-01-206A-3+N5350
177	132.00	Industrial	246	R8	ACS880-01-246A-3+N5350
214	160.00	Industrial	293	R8(3)	ACS880-01-293A-3+N5350
268	200	Industrial	363	R9(6)	ACS880-01-363A-3+N5350
335	250.00	Industrial	430	R9(5)	ACS880-01-430A-3+N5350

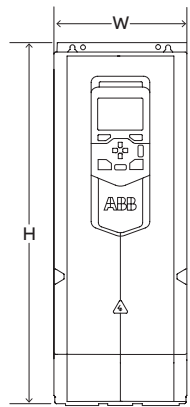
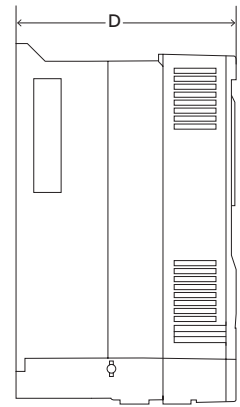
\*For use only outside USA



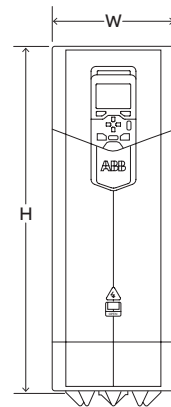
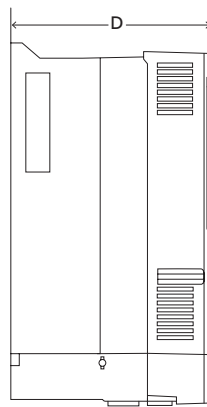
R1



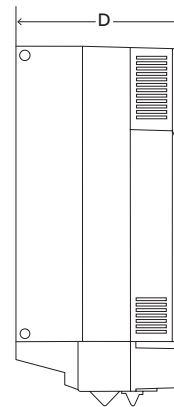
R2

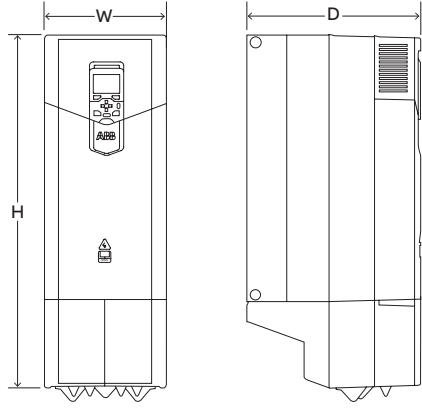


R3

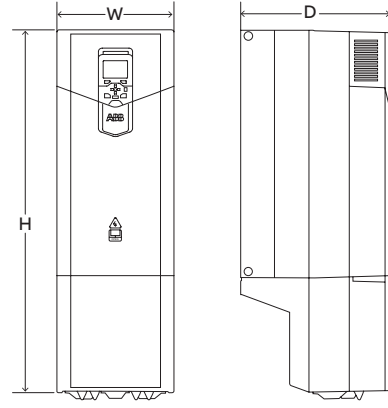


R4

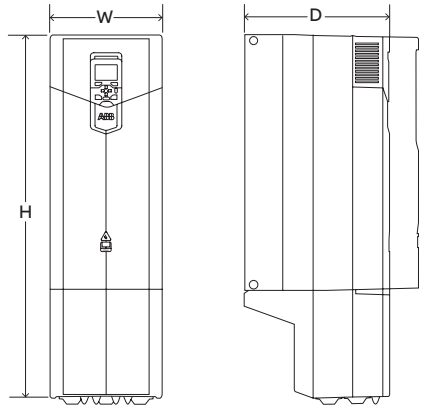




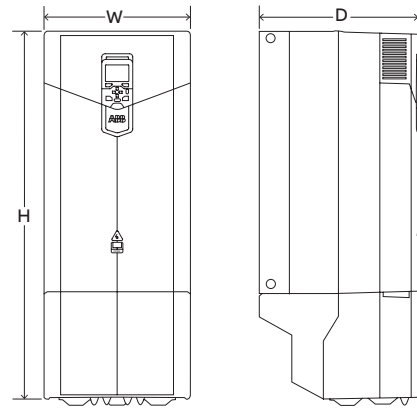
R6



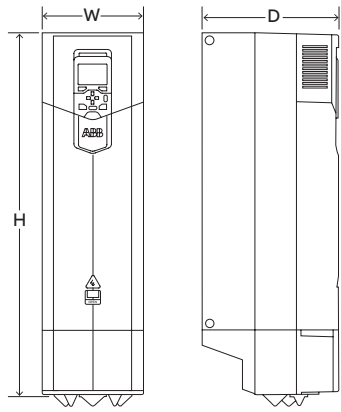
R7



R8



R9



R5

Frame Size	Product dimensions – inches (mm.)							
	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

## Cooling tower motor RFQ

**Company name:** \_\_\_\_\_ **Project:** \_\_\_\_\_

Fan speed (RPM) \_\_\_\_\_ Ambient temp. \_\_\_\_\_

Existing motor Hp \_\_\_\_\_ Static pressure (inches of H<sub>2</sub>O) \_\_\_\_\_

Fan shaft Hp \_\_\_\_\_

(This is normally an odd number ex: 42.3 Hp based on operating condition)

Voltage \_\_\_\_\_

Height restrictions Yes  No

"A" inches \_\_\_\_\_

(If yes, please give maximum height from motor to mounting plate to shaft extension. See diagram "A" dimension)

Match existing bolt hole pattern? Yes  No

If yes, please give existing bolt hole pattern \_\_\_\_\_

Air velocity in region of motor (ft./min.) \_\_\_\_\_

(This is normally an odd number ex: 42.3 Hp based on operating condition)

If retrofit ...

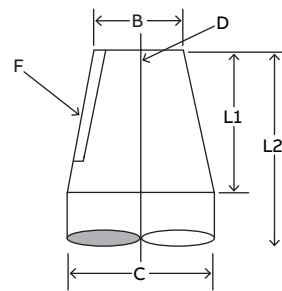
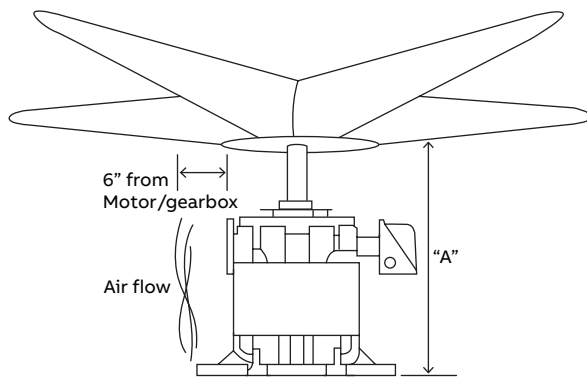
Gearbox manufacturer \_\_\_\_\_

Gearbox model no. \_\_\_\_\_

The solution requires a ABB ACS880+N350 CTDD Drive

Approximate distance from motor to VFD location \_\_\_\_\_ Feet

Drive location: control room \_\_\_\_\_ Outside: \_\_\_\_\_



Small end dia. "B" \_\_\_\_\_

Large end dia. "C" \_\_\_\_\_

Length of taper "L1" \_\_\_\_\_

Length of exposed shaft "L2" \_\_\_\_\_

Keyway size "F" \_\_\_\_\_

Shaft end drilled & tapped hole "D" \_\_\_\_\_



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