BALDOR • RELIANCE









Baldor Adjustable Speed Direct Drive Cooling Tower Motor and Drive System



BALDOR

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 HVAC communication protocols.



Direct Drive RPM AC Synchronous PM Motor Reduces Maintenance Cost

The RPM ACTM 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.

Baldor VS1CTD PM Cooling Tower Drive

The Baldor VS1CTD integrates custom features that have been designed exclusively for the cooling tower industry. The VS1CTD utilizes our Matched Performance philosophy to pair each RPM AC PM motor with a specific control. Critical motor operational parameters are integrated right into the VS1CTD firmware to provide simplified Cooling Tower startups, eliminating the need for users to enter complex information into the control or the need to tune the control to the motor prior to operation. Since the VS1CTD is targeted for use in the cooling tower market, much of the complexity that typically resides in general purpose controls has been eliminated further adding to the simplicity of our Adjustable Speed Direct Drive Cooling Tower Motor and Drive System.



When system automation and control is a requirement for your cooling tower operation, the Baldor drive readily communicates with multiple communication networks including MODBUS-RTU, MODBUS/TCP, LonWorks, Metasys-N2, BACnet, EtherNet/IP, DeviceNet and PROFIBUS.

Field Tested Reliability

After extensive Lab testing at Baldor's facility, motor and drive systems have been installed and field tested for as long as three years. 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 compared to the one converted to use Baldor's Adjustable Speed Direct Drive Motor and Drive System. Each tower had the same 5 blade 18 foot diameter fan. The conversion was made in less than a day. Performance results, which were verified by a third party, measured an 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.

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 because there are fewer mechanical components
- Water-tight motor design operates in the air stream
- Eliminates the alignment of mechanical components for guicker installation and reduced installation costs

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

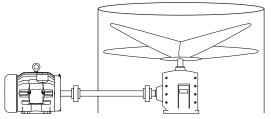
- Designed specifically for the Cooling Tower Industry and can be set at the optimum speed point
- Sensorless Permanent Magnet motor control operates without an encoder or resolver
- Trickle heating eliminates need for motor space heaters
- No tuning is required due to the Matched Performance of the motor and control
- Allows for a soft start (controlled ramp)
- Saves energy and reduces mechanical stress on the system
- Improves system reliability and extends life
- Reduces noise
- Allows for optimized return water cooling temperature for optimized compressor operation
- Trickle current for braking prevents fan windmilling when not in operation
- System resonance speeds can be bypassed

Communication Protocols

- Utilizes MODBUS-RTU, MODBUS/TCP, EtherNet/IP, LonWorks, Metasys-N2, BACnet, DeviceNet or PROFIBUS protocols
- Interfaces with existing building automation systems

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, FL440 and FL5800.



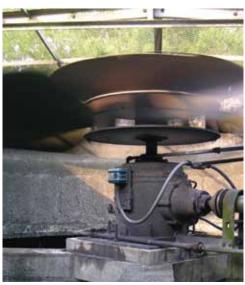
Conventional Tower Design



New Direct Drive Tower Design

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

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



RPM AC Cooling Tower Motor and Drive Specifications

Motor

Motor Frame Size	Max. Torque (lb. ft.)	Min. Re- quired Air Velocity (ft/min)	Aprox. Wgt. (lb)	*Est. Motor Height "M" (in.)	Catalog Number
FL2554	90		375	15	Custom
FL2562	155	F00	440	17	Custom
FL2570	215	500	515	19	Custom
FL2578	290		590	21	Custom
FL2873	305		610	19	Custom
FL2882	415	750	705	21	Custom
FL2890	510	730	790	23	Custom
FL2898	590		860	25	Custom
FL4472	500		1154	18	Custom
FL4477	720		1290	19	Custom
FL4485	1050		1515	21	Custom
FL4493	1375		1730	23	Custom
FL4402	1820	750	1980	25	Custom
FL4413	1275		2290	28	Custom
FL4421	2740		2510	30	Custom
FL4429	3050		2730	32	Custom
FL4440	3520		3035	35	Custom
FL5816	4744		5445	37	Custom
FL5818	5400		5880	39	Custom
FL5820	6058		6315	41	Custom
FL5822	6715		6750	43	Custom
FL5824	7372	750	7185	45	Custom
FL5826	8029		7620	47	Custom
FL5828	8686		8055	49	Custom
FL5830	9343		8490	51	Custom
FL5832	10000		8925	53	Custom

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.

Drive

Max. Amps	НР	Frame	Catalog Number			
240 Vac						
19.4	5	AA	VS1CTD25-1B			
19.4	7.5	AA	VS1CTD27-1B			
37.0	10	В	VS1CTD210-1B			
47.5	15	В	VS1CTD215-1B			
59.8	20	В	VS1CTD220-1B			
70.4	25	C	VS1CTD225-1B			
91.5	30	C	VS1CTD230-1B			
91.5	40	C	VS1CTD240-1B			
147.5	50	D	VS1CTD250-1B			
147.5	60	D	VS1CTD260-1B			
		Vac	10.0.0200.0			
11.9	10	AA	VS1CTD410-1B			
23.0	15	В	VS1CTD415-1B			
28.9	20	В	VS1CTD420-1B			
34.0	25	В	VS1CTD425-1B			
44.2	30	С	VS1CTD430-1B			
55.3	40	C	VS1CTD440-1B			
65.5	50	С	VS1CTD450-1B			
90.8	60	D	VS1CTD460-1B			
116.6	75	D	VS1CTD475-1B			
136.3	100	D	VS1CTD4100-1B			
143.8	125	D	VS1CTD4125-1B			
204.0	150	E	VS1CTD4150-1T			
256.7	200	Е	VS1CTD4200-1T			
	600	Vac				
9.4	10	AA	VS1CTD510-1B			
18.7	15	В	VS1CTD515-1B			
23.0	20	В	VS1CTD520-1B			
27.2	25	В	VS1CTD525-1B			
33.6	30	С	VS1CTD530-1B			
42.6	40	С	VS1CTD540-1B			
50.8	50	С	VS1CTD550-1B			
72.8	60	D	VS1CTD560-1B			
93.1	75	D	VS1CTD575-1B			
117.5	100	D	VS1CTD5100-1B			
132.8	125	D	VS1CTD5125-1B			
173.6	150	Е	VS1CTD5150-1T			
218.8	200	E	VS1CTD5200-1T			

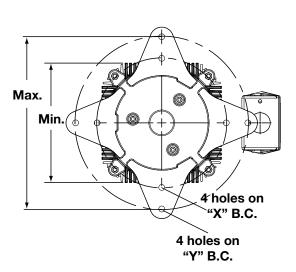
Select drive based upon motor full load amps.

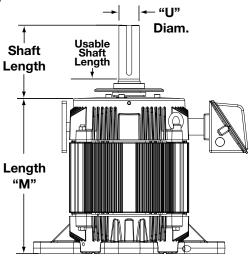
For line and load reactors see the Baldor 501 catalog.

RPM AC Cooling Tower Motor Dimensions

Select motor frame size based upon required fan torque

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
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.

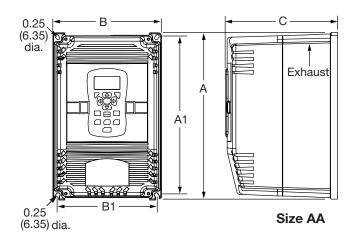
Tapered shafts are also available. Typical taper is 1/2" per foot. Special non-standard shaft requirements must be defined on the order.

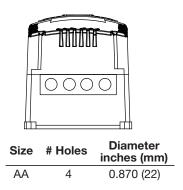
Motor Features

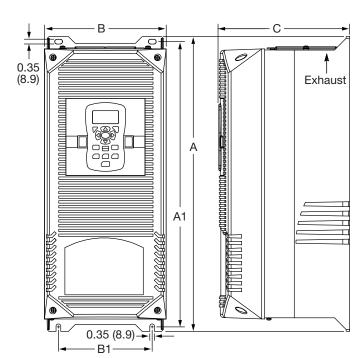
- · Mounting pad for vibration sensor
- Thermostats one per phase normally closed
- Heavy build external coatings
- Proven Inpro/Seal® bearing isolator with slinger umbrella over seal
- Proven insulation system technology used in off-shore drilling applications

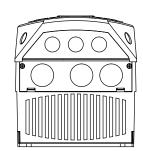
Adjustable Speed Drive Cooling Tower Dimensions

Select drive rating and frame size based upon motor full load amps









Size	# Holes	Diameter inches (mm)
В	3 3	1.115 (28.3) 1.362 (34.6)
С	3 3	1.115 (28.3) 1.680 (42)
D	3 2 1 1	1.115 (28.3) 2.470 (62.7) 1.362 (34.6 0.500 (12.7)
E	3 2 1 1	1.115 (28.3) 4.000 (102) 1.680 (43) 0.500 (12.7)

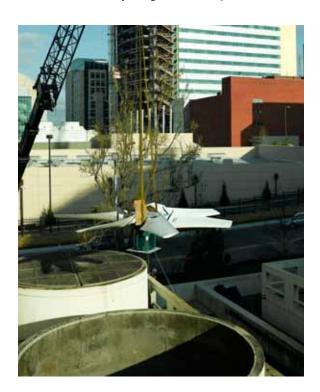
Sizes B. C. D and E

_						
Frame Size	Outside			Mounting		Weight Ib (kg)
3126	Height (A)	Width (B)	Depth (C)	Height (A1)	Width (B)	ib (kg)
AA	12.27 (311)	7.97 (202)	8.21 (208)	11.75 (298)	7.38 (187)	20 (9.1)
В	18 (457)	9.10 (231)	9.75 (248)	17.25 (438)	7.00 (178)	30 (13.6)
С	22 (559)	9.10 (231)	9.75 (248)	21.25 (540)	7.00 (178)	60 (27.2)
D	28 (711)	11.50 (292)	13.00 (330)	27.25 (692)	9.50 (241)	120 (54.4)
E	42.81 (1087)	18.75 (476)	16.06 (407)	39.75 (1010)	15.75 (400)	250 (113.4)

Custom enclosures including NEMA 4X are avilable

Easy Field Installation

Below is a motor fan assembly being lowered into position.



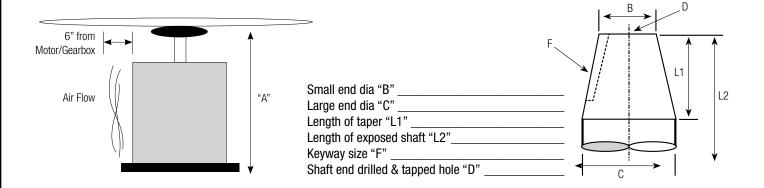






Baldor Cooling Tower Motor RFQ

Company Name:	Project:	:			
Fan Diameter (ft.) Air F		ow (cfm)			
Fan Speed (RPM)					
Existing Motor Hp	_ Static Pre				
Fan Shaft Hp(This is normally an odd number ex: 42.3 Hp based on operating conditions)	_ Air Densit				
Voltage Required	_ Fan mfq F	P/N			
Height Restrictions YES / NO	_ No. Fan B	lades			
If Yes, please give maximum height from motor to mounting plate to shaft extension Match Existing Bolt Hole Pattern? YES / NO If Yes, please give existing Bolt Hole Pattern Air Velocity in Region of Motor (ft/min)	_	· 			
(shaded area shown below)		Fan Shaft Diameter (in.)	Keyway (in.)		
If retrofit		1.999" ± .0005"	1/2" x 1/4"		
Gearbox Manufacturer		2.374" ± .0005"	5/8" x 5/16"		
Gearbox Model No		2.624" ± .0005"	5/8" x 5/16"		
The Baldor Solution requires a Baldor CTPM VFD		2.999" ± .0005"	3/4" x 3/8"		
Approximate distance from motor to VFD location	Feet	Other Shaft Dia. Req	uirements		
Drive location: Control Room Outside:					



Required information to quote properly Questions regarding above information Please contact your local Baldor District Office



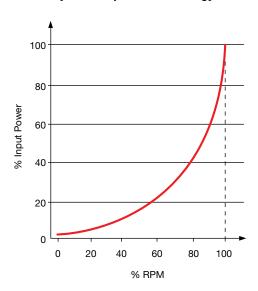
V*S Control Provides Optimized Cooling Tower Performance and Energy Savings Even Under Low Load Conditions

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.

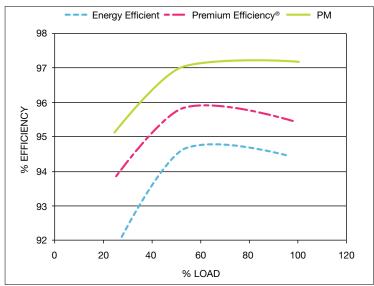
As the speed of the motor is decreased, the air flow drops in a corresponding linear fashion. So, for example, if the motor runs at only 50% speed, the air flow is correspondingly reduced to 50% of maximum air flow.

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

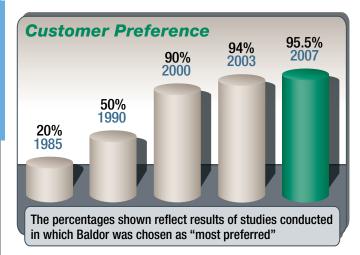


Permanent Magnet Maintain Efficiency Over Wide Load Range



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.

Why Baldor?



For nearly 100 years, Baldor has strived to provide customers with the best value and reliability in industrial electric motors. That dedication shows in customer preference for Baldor•Reliance motors. To be considered as the most preferred...

Baldor offers the industry's broadest line of stock products. Save valuable time with just one call to Baldor. We offer more than 10,000 stock motors, drives, gearboxes, bearings and PT components.

Energy-efficiency leader. Baldor began lowering the energy consumption of our motors in the 1920's, long before others were even talking about it. Today, Baldor's expansive line of Premium Efficiency motors extends from 1 through 15,000 Hp. Baldor's motors offer customers the highest overall efficiency levels in the industry, including Baldor●Reliance Super-E[®] (1 through 500 Hp) motors that exceed NEMA Premium[®] efficiencies.

Baldor continually looks for applications where improvements in energy efficiency is possible. By replacing conventional cooling tower fan drive systems with Baldor's adjustable speed direct drive motor and drive system, significant improvements in energy efficiency are possible.



Baldor products are available at more locations than any other brand.

Our 35 district offices across North America and offices around the world, offer immediate and local availability of Baldor products to thousands of customers.

Continuous innovation to improve reliability.

Baldor leads the motor industry in applying new technologies to improve motor reliability. Recent improvements to the line of Severe Duty motors are further proof that Baldor is the leader in motors for process industry applications. These improvements are explained in detail in the following pages.

Industry's shortest lead times/Flexible manufacturing.

Baldor has the industry's shortest lead times on custom motors. Our unique LEAN FLEX FLOWTM manufacturing process lets us produce any order in



any quantity, quickly and efficiently.

Industry's best information. Only Baldor offers customers so many choices for product information with a wide variety of catalogs and product brochures, the Baldor Web site at www. baldor.com, or you may talk to a Baldor customer service person at one of our sales offices.

Leadership in Premium Efficiency

Called a "key breakthrough" by the Consortium for Energy Efficiency, the CEE in 1998 recognized Baldor's Super-E as the first premium efficient motor line to meet their stringent efficiency criteria, citing "For the first time, one manufacturer will carry all qualifying products."

Minimum Efficiency Performance Standards (MEPS) for electric motors are becoming commonplace throughout the world. The first of these was the Energy Policy Act of 1992 (EPAct) that mandated efficiency levels for 1-200 Hp general purpose motors for sale in the U.S. after October 1997. The Energy Independence and Security Act of 2007 (EISA) builds upon EPAct and raises the efficiency level for these motors to NEMA Premium® efficiency adds other configurations and 201-500 Hp ratings for MEPS compliance. Baldor•Reliance Super-E motors manufactured today meet or exceed EISA requirements.

As countries and regions across the world establish minimum efficiency levels for motors, more companies are turning to the Baldor•Reliance Super-E. This includes plant and processing applications, as well as OEM products for shipment overseas. Super-E motors meet or exceed the efficiency levels defined by NEMA Premium®, EPAct in the U.S., NRC in Canada. CEMEP EFF1 in Europe, and the new IE3 level of IEC 60034-30.

A wide selection of premium efficient motors, available from stock, manufactured and sold by a company committed to building better products for industries worldwide. No wonder, since the 1920s, Baldor•Reliance is recognized as the leader in energy efficient industrial motors and drives.



A Baldor Super-E motor and Inverter Control provide premium energy efficiency and improved process control to a municipal water treatment facility.

Making Energy Efficiency Work For You

Why is Energy Efficiency Important?

Electric motor-driven systems used in industrial processes consume 63% of all electricity used in U.S. industrial sector according to a U.S. Department of Energy report published in 1998. A 2002 report shows that companies that practiced DOE "best practices" actually averaged 33 percent savings if they were to apply motor and motor system efficiency upgrades, including the use of adjustable speed drives. The potential positive impacts on companies' bottom lines and the environment are significant.

Purchase Price is Only a Small Piece of the Pie

The pie chart to the right shows the typical life cycle cost of a 100 Hp motor operating in continuous duty over a 20-year life. As you can see, the original purchase price is almost insignificant compared to what it will cost to power the motor during its useful life.

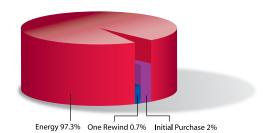
How Baldor Super-E® Efficiencies Compare to Industry Standards

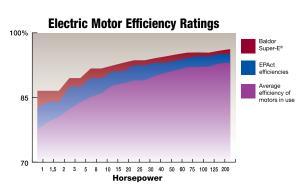
Baldor's line of Super-E motors offers customers the highest level of overall efficiencies available from any motor manufacturer, meeting or exceeding NEMA Premium® efficiency.

BE\$T® Baldor Energy Savings Tool Makes Calculating Payback Easy

In order to make payback calculations easier for customers, Baldor developed BE\$T, Baldor Energy Savings Tool. The software helps calculate energy cost and energy savings for motors, as well as payback time frames. A popular feature of BE\$T is that it allows users to make head-to-head comparisons of up to three motors, giving customers the information to make an informed decision through comparative analysis.

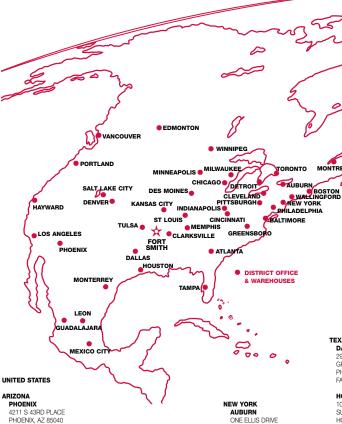
BE\$T, Baldor Energy Savings Tool is available as a download through Baldor's award-winning Web site (www.baldor.com/support/software_BEST.asp,) as well as a stand-alone CD-ROM, available from your Baldor District Office.







BALDOR SALES OFFICES



ARKANSAS CLARKSVILLE

1001 COLLEGE AVENUE CLARKSVILLE, AR 72830 PHONE: 479-754-9108 FAX: 479-754-9205

PHONE: 602-470-0407

FAX: 602-470-0464

CALIFORNIA LOS ANGELES

6480 FLOTILLA STREET COMMERCE, CA 90040 PHONE: 323-724-6771 FAX: 323-721-5859

HAYWARD

21056 FORRES AVENUE HAYWARD, CA 94545 PHONE: 510-785-9900 FAX: 510-785-9910

COLORADO

3855 FOREST STREET DENVER, CO. 80207 PHONE: 303-623-0127 FAX: 303-595-3772

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65 SOUTH TURNPIKE ROAD WALLINGFORD, CT 06492 PHONE: 203-269-1354 FAX: 203-269-5485

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INDIANA INDIANAPOLIS

5525 W. MINNESOTA STREET INDIANAPOLIS, IN 46241 PHONE: 317-246-5100 FAX: 317-246-5110

DES MOINES

1800 DIXON STREET, SUITE C DES MOINES, IA 50316 PHONE: 515-263-6929 FAX: 515-263-6515

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6660 SANTA BARBARA RD. SUITES 22-24 ELKRIDGE, MD 21075 PHONE: 410-579-2135 FAX: 410-579-2677

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BOSTON 6 PULLMAN STREET WORCESTER, MA 01606 PHONE: 508-854-0708 FAX: 508-854-0291

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5993 PROGRESS DRIVE STERLING HEIGHTS, MI 48312 PHONE: 586-978-9800 FAX: 586-978-9969

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ST LOUIS 422 INDUSTRIAL DRIVE MARYLAND HEIGHTS, MO 63043 PHONE: 314-298-1800 FAX: 314-298-7660

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AUBURN, NY 13021 PHONE: 315-255-3403 FAX: 315-253-9923

NORTH CAROLINA

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CINCINNATI

2929 CRESCENTVILLE ROAD WEST CHESTER, OH 45069 PHONE: 513-771-2600 FAX: 513-772-2219

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OKLAHOMA

TULSA 7170 S. BRADEN, SUITE 140 TULSA, OK 74136 PHONE: 918-366-9320 FAX: 918-366-9338

PORTLAND 20393 SW AVERY COURT TUALATIN, OR 97062 PHONE: 503-691-9010 FAX: 503-691-9012

PENNSYLVANIA

PHILADELPHIA 1035 THOMAS BUSCH MEMORIAL HIGHWAY PENNSAUKEN, NJ 08110 PHONE: 856-661-1442 FAX: 856-663-6363

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SALT LAKE CITY 2230 SOUTH MAIN STREET SALT LAKE CITY, UT 84115 PHONE: 801-832-0127 FAX: 801-832-8911

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AUSTRALIA

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UNIT 8, 5 KELLETTS ROAD ROWVILLE, VICTORIA, 3178 AUSTRALIA PHONE: (61) (3) 9753 4355 FAX: (61) (3) 9753 4366

EL SALVADOR

RESIDENCIAL PINARES DE SUIZA POL. 15 #44, NVA. SAN SALVADOR, EL SALVADOR PHONE: +503 2288-1519 FAX: +503 2288-1518

CHILE

LUIS THAYER OUEDA 166 OF 402 - PROVIDENCIA SANTIAGO, CHILE PHONE: +56 2 816 9900

160 SONG SHENG ROAD SONG JIANG INDUSTRY ZONE SHANGHAI 201613, CHINA PHONE: +86 21 5760 5335 FAX: +86 21 5760 5336

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DIESEL STRASSE 22 D-85551 KIRCHHEIM MUNICH, GERMANY PHONE: +49 89 90 5080 FAX: +49 89 90 50 8492

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INDONESIA

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VIA SOTTOBISIO 30 BALERNA CH-6828 PHONE: +41 91 683 6161 FAX: +41 91 630 2633

JAPAN

DIA BLDG 802, 2-21-1 TSURUYA-CHO, KANAGAWA-KU YOKOHAMA, 221-0835, JAPAN PHONE: 81-45-412-4506 FAX: 81-45-412-4507

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PANAMA

AVE. RICARDO J. ALFARO EDIFICIO SUN TOWERS MALL PISO 2, LOCAL 55 CIUDAD DE PANAMÁ, PANAMÁ PHONE: +507 236-5155 FAX: +507 236-0591

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SWITZERLAND

POSTFACH 73 SCHUTZENSTRASSE 59 CH-8245 FEUFRTHALEN CH-8245 FEUERTHALEN SWITZERLAND PHONE: +41 52 647 4700 FAX: +41 52 659 2394

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