

GE  
Power Conversion

# MV6 Series

The flexible, general purpose  
medium voltage drive



ecomagination



## Drive technology for the challenges of tomorrow

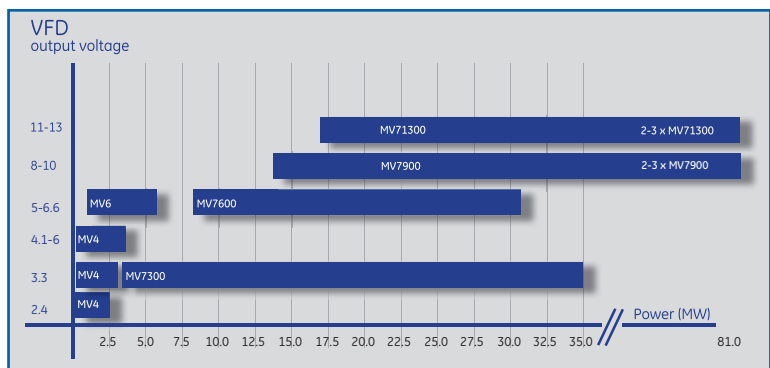
Enabling increased efficiency, accuracy and flexibility in your processes, GE offers an advanced air-cooled medium voltage drive for efficient motor control. Building on our extensive experience, the MV6 Series drive provides a flexible and effective approach using a simple power architecture to achieve low cost of ownership across many applications. Easy to install and maintain, the MV6 Series can save space in the electrical room, and offer high availability – all critical factors to improving your performance and process effectiveness.

All MV6 Series drives come equipped with Visor Connect – a remote monitoring system which connects the device to GE’s global experts for real-time service support when needed and helps prevent unscheduled downtime.

The MV6 Series is part of GE’s medium voltage drive family which offers a wide power range at various voltages to cover a variety of applications.

### Benefits:

- **Equipped with a 36 pulse rectifier or active front-end input** which meets the most stringent harmonic distortion requirements.
- **Motor-friendly sinusoidal output** making it compatible with motor and cable standard insulation systems.
- **Multilevel medium voltage topology** using standard low voltage IGBTs and modular building blocks that are quick and easy to service.



The MV6 Series belongs to GE's wide range of drives for all applications.

## Why a variable frequency drive?

### Simple & efficient control of your process

Variable frequency drives (VFDs) regulate motor speed to control the flow and pressure of blowers or pumps without dampers or throttling valves. This results in energy savings and minimizes output waste. VFDs also provide a soft start to the motors, reducing the stress on driven load and resulting in lower maintenance costs.

### Appropriate power usage in response to load

A VFD manages power based on actual demand and uses only the energy required by the driven equipment to provide valuable energy savings.

### Avoid peak demand charges

When starting large motors with VFDs, current inrush peaks are eliminated. The VFD gradually ramps the motor up to speed by varying output voltage, current and frequency for a soft start.

## Variable frequency drives can be used in a variety of industries and applications

Industry sector	Applications
Petrochemicals, oil and gas	Pumps, compressors, soft starters, electrical submersible pumps, extruders, blowers, mixers
Water	Pumps, blowers, aerators
HVAC	Chillers, fans
Power generation	ID fans, FD fans, feed water pumps, transfer/booster pumps, conveyors, centrifuges, wind turbines
Cement and mining	Mills, crushers, pumps, fans, conveyors
Paper and pulp	Vacuum pumps, chippers, refiners
Metals	Fans, pumps

# MV6 Series — A game-changing product

## Key benefits

- User choice of input rectifier:
  - Diode front-end (DFE) input is easy to install with integrated transformer and flexibility of primary voltage
  - Active front-end (AFE) is transformerless with a small/lightweight footprint and four-quadrant regenerative braking capability
- Arc flash protected
- Modular construction
  - Quick and easy power module replacement
  - Three wire in and out cable connections — plug & play
- Conservatively rated standard IGBT's provide high availability and low maintenance costs
- Visor Connect supports warranty with remote real-time support and advice

## Power quality benefits

- Low input harmonics for better power grid performance
- High power factor to increase energy savings
- Motor-friendly output — suitable for new and retrofit applications

## Process control benefits

- Power dip ride-through to eliminate nuisance trips
- Under-voltage operation to sustain the process
- Flying start into spinning load — for quick ramp-up of process
- Critical speed avoidance to ride-through the resonance frequencies
- Independent acceleration and deceleration ramps
- Ease of set-up & diagnostics



2750 kW, 6600 Volt, AFE

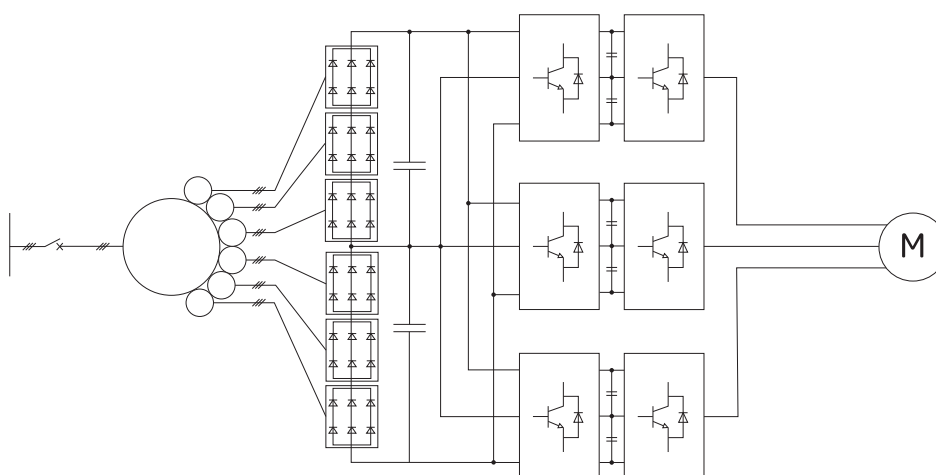
## Key benefits — Choice of input rectifier

### Diode Front-End (DFE)

The flexibility of the MV6 Series choice of integrated transformer and 36 pulse DFE product allows for clean harmonic input signature for applications that only require two quadrant motoring operation. The input transformer is prepackaged and allows for ease of application to customer utility systems where the input voltage may be higher than the motor voltage. Commonality is maintained in the VFD inverter power modules to the AFE option to allow for overall low spare parts inventory.

### DFE with transformer

- Integrated transformer simplifies installation and commissioning
- 36 pulse rectifier helps simplify input harmonics
- Line side connection flexibility with choice of input voltages- 3.3, 6, 6.6, 6.9, 10, 11, 13.2 & 13.8 kV
- Provides .96 true input power factor across speed range (20-100% load). No power factor correction capacitors required.



36 pulse DFE system architecture with flexible input voltage.

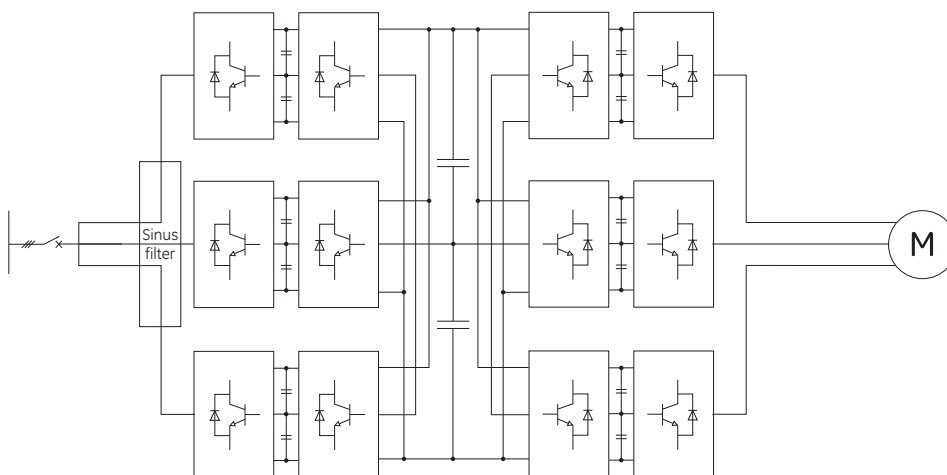
## Active Front-End (AFE)

The flexibility of the MV6 Series choice of AFE allows for a clean harmonic input signature for applications that require motoring and regenerative braking operations. The AFE transformerless design provides an overall higher efficiency (>97.5%) reducing operating costs. This design greatly reduces control room heat load therefore requiring less space and HVAC requirements. Due to the smaller size and low weight the AFE also offers lower transportation costs.

- Mitigates input harmonics and is more supportive to grid transitions
- Reduced heat load and smaller space and HVAC requirements in the control room
- Provides unity input power factor across speed range. No power factor correction capacitors required. VARs can be supplied to utility as an option
- Four quadrant operation
  - Ability to transmit power back to the utility lines, helping to save energy
  - Inherent braking capability to slow high inertia loads quickly such as ID fans without the needs from braking resistors
  - Excellent ability to overhaul loads such as downhill conveyors

## Transformerless AFE

- Simpler, smaller and lighter, while limiting the supply harmonics and increasing the motor insulation life



AFE system architecture

## Arc flash protected – design for personnel safety

- Enclosure reinforced against arc flash effect
- Anti-flash design on doors and panels
- Equipped with over-pressure relief vents
- Quick installation for lower cost of ownership
- Less process downtime for greater plant output

## Modular construction

- Easy power module replacement
- Common building blocks – reduced spare parts cost and lower cost of ownership

## Quick & easy installation

- Three cables in; three cables out
- Top, bottom or both cable entry/exit

## High availability

The MV6 Series utilizes rugged IGBT power modules that provide high reliability with a low life-cycle cost. The modular design includes common power modules that are used for both DFE and AFE power circuits.

The standard power module reduces the overall MTTR and increases the availability of the drive. Each power module and power circuit is tested at full power prior to shipment from the factory.

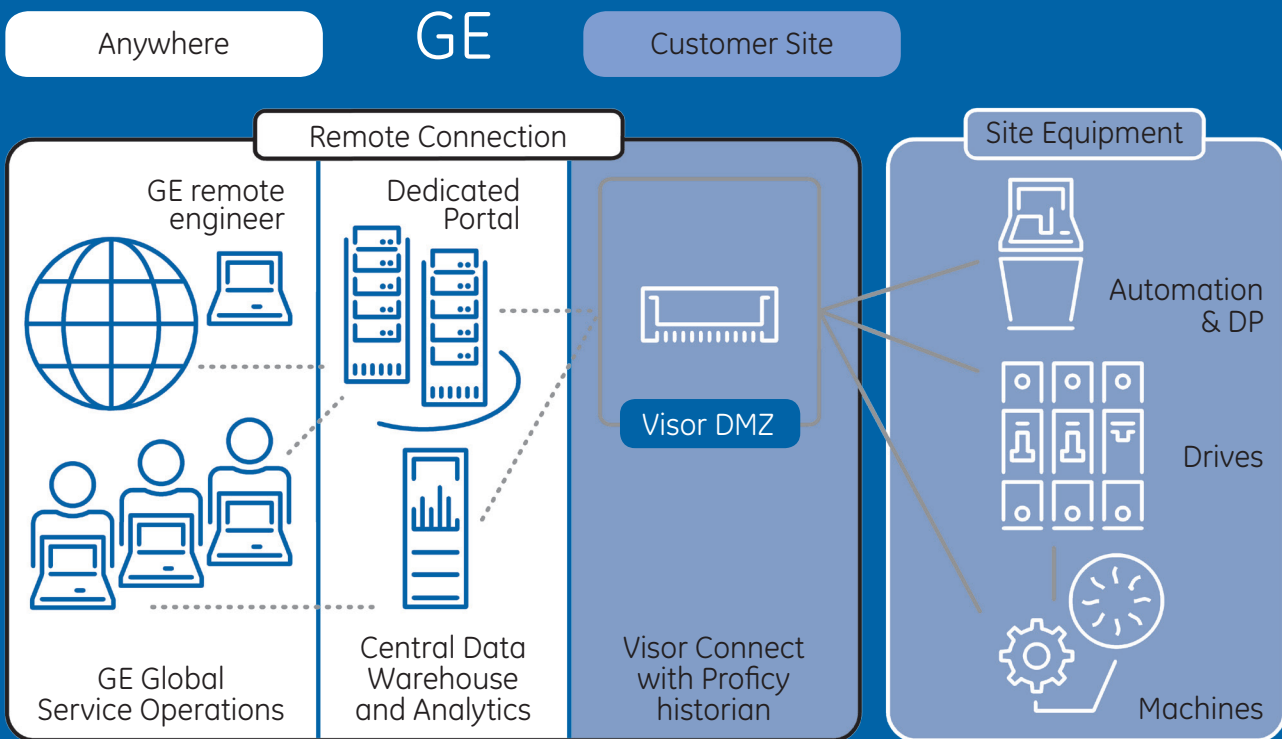
## High efficiency and low losses

The MV6 Series delivers higher efficiency for greater available power, compared to the typical installation. Low heat emissions reduce air-conditioning requirements in the control room and overall cost of ownership.

	MV6 Series DFE with Transformer	MV6 Series AFE
VFD	98.5%	97.5%
Transformer	98%	-
System Efficiency	96.5%	97.5%

AFE: Active Front End; DFE: Diode Front End; Efficiency at full load and full speed





## Visor Connect: Remote connection to equipment, monitoring and support

Visor Connect provides secured remote connection to GE equipment (outside the control network). Remote connection enables GE's service engineers to provide real-time support, ongoing health analytics and key performance indicators (KPIs), as well as basic configuration management support.

### Key benefits

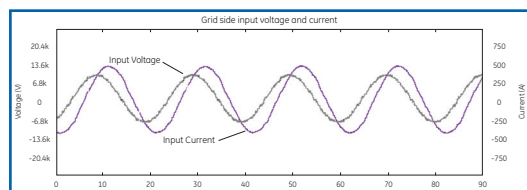
- Reduce unscheduled downtime
- Real-time support and advice
- Customers can access GE's global Services organization 24/7, 365 days a year from anywhere in the world

# Power quality benefits

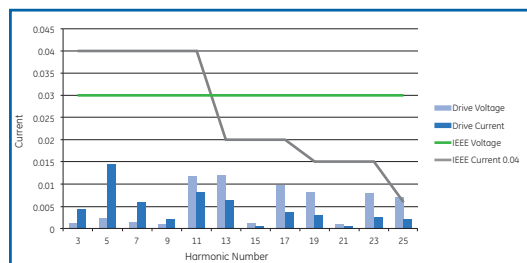
## Power quality input

Using either the 36 pulse DFE or the AFE option, the MV6 Series more than meets the industry requirements for harmonic limits.

- Clean power input
- IEEE 519-1992 standard compliant
- No external filters
- No harmonic disturbance to other online equipment



Typical input waveforms



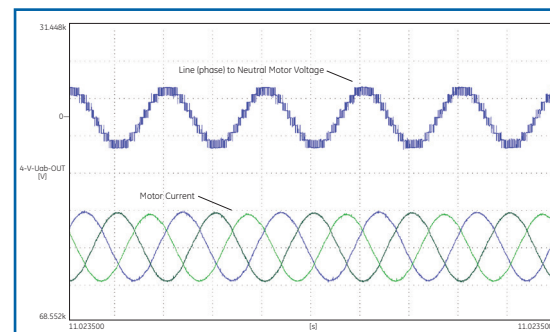
Typical harmonic contents of input for pulse system

## Input power factor

- .96 power factor DFE or unity (default) power factor AFE for energy savings
- No need for power factor correction equipment
- With AFE, VARs can be supplied to utility lines as an option

## Motor-friendly output — drive of choice for new & retrofit applications

- Five-level PWM output — simulates a sinewave providing smooth output waveform to the motor
- Low VFD-induced torque ripple
- No special motor insulation
- No motor de-rating
- Works with standard motors
- Good for new and retrofit applications



MV6 Series output voltage and motor current

## Process control benefits

### Power dip ride-through

The MV6 Series drive provides six-cycle power loss ride-through and keeps the process running without tripping.

### Under-voltage operation

The MV6 Series operates continuously and provides available power to the motor at a lower input supply voltage (up to 70% of nominal voltage).

### Flying start into a spinning load

The MV6 Series offers the ability to catch and take control of a spinning load without any damaging torque impacting the equipment if restarted while the load is already spinning.

### Critical speed avoidance

The MV6 Series drive can be programmed for up to three critical frequency bands and ride-through these without any resonance issues.

### Independent acceleration and deceleration ramps

The MV6 Series can be programmed into the drive controls as needed for controlled starting and stopping of the load.

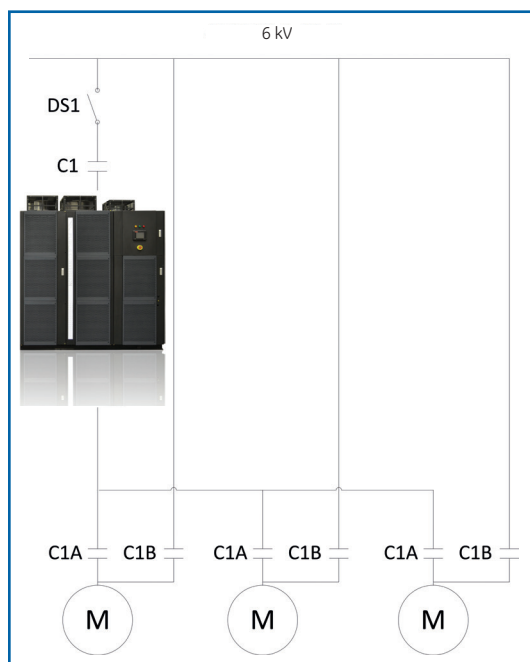
### Ease of set-up & diagnostics

- Standard control interface offers digital inputs/outputs and analog inputs/outputs as standard. Each of these inputs/outputs can be programmed to a variety of different functions for flexibility.
- Touchscreen operator interface allows for quick, user-friendly programming. Screens for fault parameters and meters are user configurable.
- MV6 Series tool suite is designed to offer a full range of programming and monitoring tools. Operating data can be captured with a snapshot feature and drive signals can be trended. In addition, tool suite offers trace-back data for detailed fault analysis.

## MV6 Series drive options

### One drive for multiple motors

- Lower capital cost
- Smaller installed footprint
- Less maintenance
- Reduced spare parts inventory



### Up and down synchronous transfer

- Start multiple motors one-by-one and transfer them on utility lines
- Run the last motor continuously on VFD at variable speed
- Increased energy savings

### À la carte option packaging

- Standard product customizable with pre-engineered options
- IP42 enclosure
- Step-down transformer for higher input voltages
- Input switchgear
- Redundant fan
- Multiple motor operation
- Additional I/Os
- Full voltage bypass
- Communication protocols
- Other customer-specific options

## DFE dimensions & weights

VFD model number	Output power kW 6 kV output	Output power kW 6.6 kV output	Output power kW 6.9 kV output	Width (mm)	Weight (tons)
DFE-MV6601	500 - 1000	550 - 1100	575 - 1150	3500	4.5
DFE-MV6603	1000 - 2500	1100 - 2750	1150 - 3000	4400	7.5
DFE-MV6606	2500 - 5000	2750 - 5500	3000 - 6000	6000	10

Cabinet height: 2200 mm  
Height with blower: 2680 mm  
Depth: 1200 mm

## MV6 Series ratings

VFD Model Number	6kV Application	6.6kV Application	6.9kV Application	Current
	Motor Shaft Power	Motor Shaft Power	Motor Shaft Power	
	kW	kW	kW	
MV6601-05	500	550	575	58
MV6601-08	750	825	863	86
MV6601-10	1000	1100	1150	115
MV6603-13	1250	1375	1450	144
MV6603-16	1500	1650	1725	173
MV6603-19	1750	1925	2025	202
MV6603-22	2000	2200	2300	230
MV6603-24	2250	2475	2600	259
MV6603-27	2500	2750	3000	300
MV6606-30	2750	3025	3150	317
MV6606-33	3000	3300	3450	346
MV6606-38	3500	3850	4025	403
MV6606-44	4000	4400	4600	461
MV6606-49	4500	4950	5175	518
MV6606-55	5000	5500	5750	576
MV6606-58	5225	5750	6000	601

Table shows the typical ratings for variable torque load applications. Please contact GE sales for constant torque applications.

## AFE dimensions & weights

VFD model number	Output power kW	Output power kW	Output power kW	Width (mm)	Weight (tons)
	6 kV output	6.6 kV output	6.9 kV output		
AFE-MV6601	500 - 1000	550 - 1100	575 - 1150	2000	2.5
AFE-MV6603	1000 - 2500	1100 - 2750	1150 - 2875	2400	3.5
AFE-MV6606	2500 - 5000	2750 - 5500	3000 - 6000	4000	5

Cabinet height: 2200 mm  
Height with blower: 2650 mm  
Depth: 1200 mm

## MV6 Series drive specifications

### VFD ratings

Output power	500 – 6000 kW
Output voltage	6, 6.6, 6.9 kV
Output frequency	0-75 Hz
Input voltage	DFE: 6.0, 6.6, 6.9, 10.0, 11.0, 13.2, 13.8 kV AFE: 6.0, 6.6, 6.9 kV
Input frequency	50 Hz; 60 Hz + /-5%
Auxiliary voltage	1 / 3 phase 230 / 400, 460, 575 V + /- 10%

### Power quality

Line side converter	36 pulse DFE or PWM AFE; IGBTs
Load side inverter	Multilevel PWM IGBTs
VFD system efficiency	DFE: 96.5% / AFE: 97.5%
Power factor	DFE: .96 power factor with 20-100% load / AFE: 1.0 power factor
Input harmonics	IEEE 519 compliant / ≤3% THVD & ≤5% THID at PCC

### Energy storage

DC link	Self-healing, long life, film capacitors
---------	--

### VFD control

Mode of operation	DFE: two-quadrant / AFE: four-quadrant
Mode of control	V/Hz; with sensor or sensor-less vector
Analog input / output	4-20 mA standard or +/-10 Vdc optional
Digital input / output	24 Vdc and relay
Speed regulation	+/- 0.5% without encoder; + /- 0.1% with encoder
Fieldbus communication interface	Modbus and TCP as standard Optional: fieldbus protocol on request
Protective functions	Overcurrent; overvoltage; over temperature; loss of phase; loss of DC link; motor overload; motor stall and over-speed; auxiliary supply fault; breaker supervision; communication fault

### Environment & enclosure

Enclosure	IP31, air-cooled, top and bottom cable entry
Ambient / elevation	0-40° C / 1,000 m above sea level; higher with de-rating
Insulation coordination	Pollution degree 2 per EN 61800-5-1 and EN 50178

### Industry standards

Standards	IEC 61800-3, 4 & 5; GB12668-3, 4 & 5
-----------	--------------------------------------

## Services from GE — a focus on availability

We understand the vital importance of process availability — and our focus on service keeps us actively engaged, both when things are going right, and when they are going wrong.

Our world-class Global Customer Service and Support Center is available 24/7, 365 days a year. Our strategic distribution centers and authorized distributors carry an extensive inventory of GE's drives, allowing us to quickly fulfill your genuine replacement part needs, no matter where you are located.

With a comprehensive global network of service engineers and technicians, GE is uniquely positioned to provide the knowledge, experience and skills for your full range of industrial service requirements. From system design to maintenance and outage support, we have the resources and capabilities to advance your equipment's performance and reliability. Some key benefits of GE's support are:

- Single point of contact
- Reduced call-out rates
- 24/7 availability
- Rapid mobilization of engineers
- Routine maintenance visits
- Training
- System health checks
- Spares management
- Obsolescence management

GE also provides managed system upgrade paths for our legacy systems and has significant experience in replacing systems from other manufacturers with low disruption to the existing infrastructure.

### Remote support

Visor Connect, GE's remote diagnostic and support system, is based on highly secure satellite communications links. It enables our experts, regardless of their geographical location, to look over the shoulder of your onsite equipment operator or technician and advise and assist you on fault finding and resolution.

## MAIN OFFICES

**Australia**, Botany  
Tel: +61 (0) 2 8313 9980

**Brazil**, Minas Gerais  
Tel: +55 31 3330 5800

**Canada**, Mississauga  
Tel: +1 905 858 5100

**Chile**, Santiago  
Tel: +56 2 652 6500

**China**, Shanghai  
Tel: +86 21 6198 2600

**France**, Massy Cedex  
Tel: +33 1 77 31 20 00

**Germany**, Berlin  
Tel: +49 30 7622 0

**India**, Chennai  
Tel: +91 44 4968 0000

**Japan**, Tokyo  
Tel: +81 3 5544 3852

**Norway**, Oslo  
Tel: +47 67 83 82 50

**Russia**, Moscow  
Tel: +7 495 981 13 13

**Singapore**  
Tel: +65 6332 0940

**South Africa**, Midrand  
Tel: +2711237 0000

**South Korea**, Busan  
Tel: +82 51 710 9015

**UAE**, Dubai  
Tel: +971 44296161

**UK**, Rugby  
Tel: +44 1788 563 563

**USA**, Pittsburgh  
Tel: +1 412 967 0765



imagination at work

[www.gepowerconversion.com](http://www.gepowerconversion.com)

Copyright © 2014 General Electric Company and/or its affiliates.  
All rights reserved. GEA30738A (02/2014)