VANGUARD™

LITHIUM-ION BATTERY SYSTEMS

1.5 - 7.0kWh PACKS, MOTORS & CONTROLLERS

TRUST VANGUARD POWER.™

OUR BATTERY STORY.

Our vision was to create a battery like no other.

THE BATTERY CHALLENGE.

It began in 2013 when Vanguard was looking for an electrification partner who had a clear understanding of the commercial market's needs — and had the ability to manufacture a battery solution that could power a broad range of applications. The battery solution would require a unique design to enable easy integration and would need to facilitate scalability based on specific power requirements. Our vision was to create a battery solution like no other — one that could endure extreme operating conditions, be dust and water resistant, withstand being pressure washed, and be easily serviceable. To achieve this goal would take a partner who could provide all of this without requiring significant volume commitments from the OEM and deliver these smaller quantities with short lead times.

THE BATTERY SOLUTION.

It soon became clear that no other partner could meet our high standards, and we enthusiastically committed to designing and manufacturing our own Vanguard™ integrated lithium-ion battery systems in-house. Owning and controlling the battery production while providing our extensive power application engineering expertise to OEMs has enabled Vanguard to establish itself as a battery power solution provider of choice. In addition, our ability to offer integrative battery solutions, scalability and supply has ensured seamless integration of Vanguard batteries into a range of applications for small, medium, and large OEMs. Vanguard provides a electrified power solution package tailored to meet a broad range of needs. We offer OEMs a complete commercial battery solution together with application engineering support and a global after-sales service and support network.

OUR PROMISE.

Providing a total solution in terms of battery, BMS and charger together with application engineering support to ensure seamless integration into your equipment.

ELECTRIFICATION. INTEGRATION. SCALABILITY.

1. **RELIABLE POWER.** Wrapped in a sealed enclosure, Vanguard batteries are built to withstand vibration, dust, and dirt, and to be washed once the job is done.

2. **SAFETY BY DESIGN.** The integrated battery management system (BMS) is responsible for the remarkable safety of Vanguard batteries.

3. **EASY INTEGRATION. NO HASSLE.** The battery modular design and use of standardized cylindrical cell formats (18650 / 21700) allow Vanguard to keep the same battery pack dimensions even if there will be new technology available in the future.

4. **AS GOOD AS ITS WORST CELL.** Vanguard works with Tier-1 cell manufacturers and uses their top-quality cells specified with very tight tolerances. Then we make them even tighter.

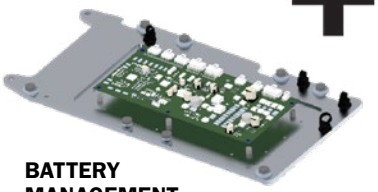
5. **COLD WEATHER CHARGING.** Vanguard batteries are specifically designed for cold weather charging from 0°C. And even at freezing temperatures when a Vanguard battery never warms up above 0°C, it still will be able to charge up to 60% SOC.

6. **GLOBAL SUPPORT.** From pre-production power integration, through sales and marketing, distribution, to infield service and support in more than 100 countries. That's Vanguard.

A TOTAL BATTERY SOLUTION — AN INTEGRATED BATTERY SYSTEM FOR A BROAD RANGE OF APPLICATIONS.

BATTERY

+



BATTERY MANAGEMENT SYSTEM (BMS)

+

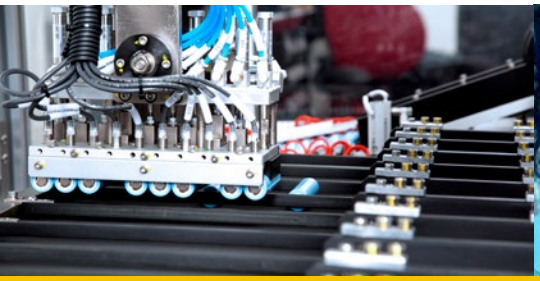
MOTOR

+

MOTOR CONTROLLER

+

CHARGER



BEST PRACTICES IN ELECTRIFICATION

Case Studies of Vanguard's Innovative Power Solutions

As one of the industry leaders in applying power to commercial applications, Vanguard works side-by-side with our customers to conquer challenges and develop innovative products. Discover Vanguard's electrification success stories through our in-depth case studies. Learn how we're collaborating with technology partners and OEMs to revolutionize operations with our advanced battery technology. Let yourself be inspired!

> READ OUR CASE STUDIES

"THE VANGUARD BATTERY PACKS DELIVER A HIGHER ENERGY DENSITY, FASTER CHARGING AND MAINTENANCE-FREE POWER, PLUS THEY CAN BE CHARGED THROUGH ANY NORMAL 230V / 115V SOCKET, WHICH MAKES THEM VERY USER-FRIENDLY FOR OUR CUSTOMERS."

Erik van Walsum, R&D Manager at ROM

"BY PARTNERING WITH SUCH A PIONEERING COMPANY...WE ARE IN THE STRONGEST POSSIBLE POSITION TO PROVIDE QUALITY SOLUTIONS THAT HAVE BEEN SPECIFICALLY TAILORED TO OUR SECTOR. WE ALSO BELIEVE THE VANGUARD BATTERY RANGE IS AHEAD OF THE CURVE IN RELATION TO EMBRACING THE TECHNOLOGICAL EVOLUTION, WITH SWAPPABLE BATTERIES BEING JUST THE START."

Frederic Lietaer, Managing Director and Head of Research and Development at ELIET

SETTING THE ONE STANDARD FOR RENTAL:

Vanguard’s Vision for Electrification

In the dynamic landscape of equipment rental, the Vanguard Battery pack stands as a beacon of standardization. Our comprehensive solution tackles the “Biggest Rental Challenges” head-on, emphasizing streamlined interoperability and cost efficiency without compromising on safety or performance.

- **STANDARDIZATION.** Our battery packs are designed with universal charging and communication protocols, ensuring they are interchangeable across a diverse spectrum of applications and equipment brands. This is the heart of our 'One Standard for Rental' philosophy.
- **TOTAL COST OF OWNERSHIP.** Vanguard's innovative approach significantly lowers the unit cost by distributing investment across multiple assets. Our maintenance-free design is a game-changer, reducing lifetime service costs and slashing TCO for your entire fleet.
- **SAFETY & DECARBONIZATION.** We prioritize safety in every cell of our batteries while steadfastly reducing carbon footprints. With Vanguard, go green without ever going into the red.
- **PRODUCT AVAILABILITY & RANGE.** Our batteries are widely available and versatile, catering to a multitude of applications from construction to landscaping, ensuring your business has the power it needs whenever it needs it.
- **PERFORMANCE.** Vanguard batteries are engineered for excellence, delivering reliable power and endurance to keep your equipment running at peak efficiency.
- **SECOND LIFE / END-OF-LIFE.** We are committed to the full lifecycle of our batteries, focusing on sustainability beyond the last charge with innovative second-life and recycling solutions.

Embrace the Vanguard standard — powering progress with batteries that work smarter, last longer, and uphold the highest safety standards.

It's not just about meeting today's needs but pioneering a greener, more efficient future for the rental industry.

DESIGNED AND BUILT FOR COMMERCIAL USE.

CYLINDRICAL CELLS

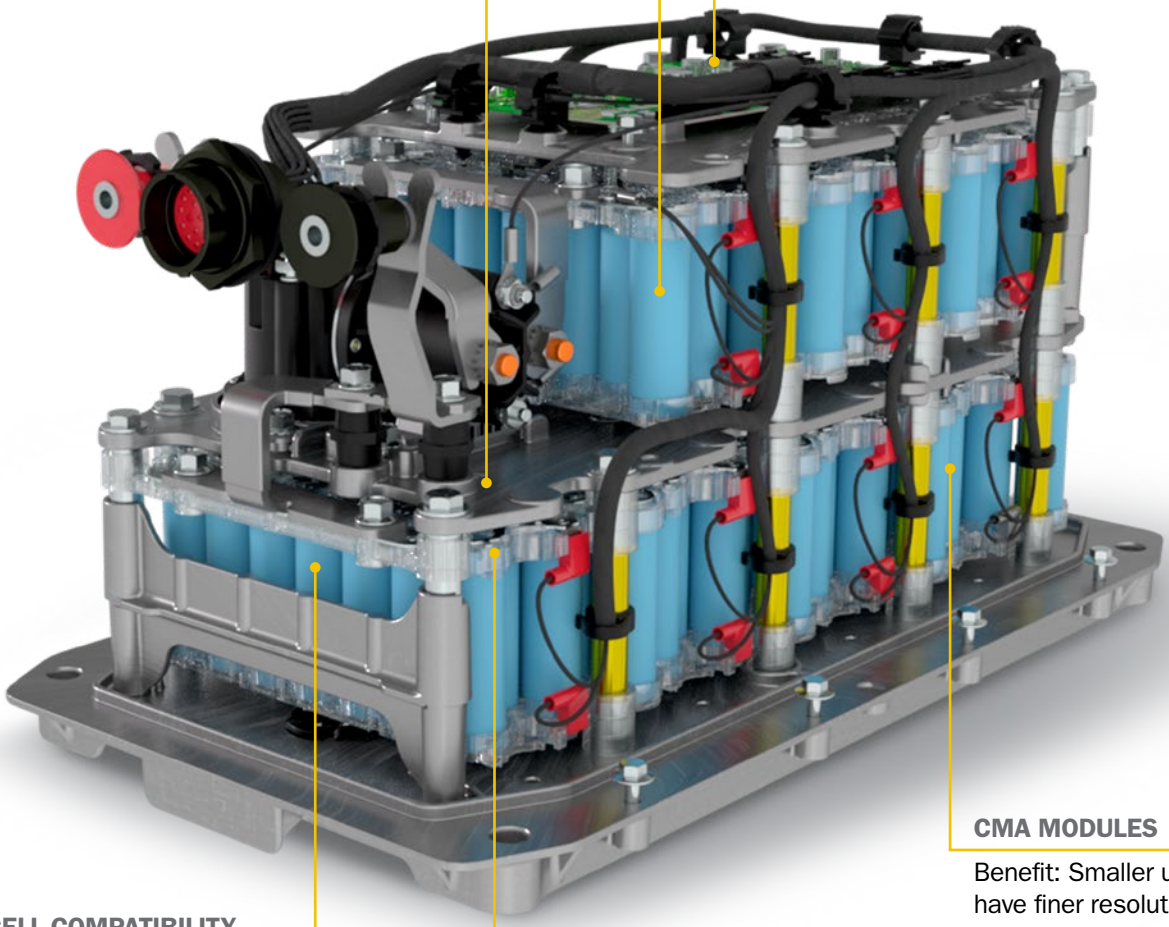
Benefit: No thermal expansion, predictable failure behavior, smallest potential energy unit.

ON-BOARD BMS

Benefit: Thermal runaway protection within each pack based on each CMA. Monitoring voltage, current, resistance, temperatures. Easy paralleling of packs. Controls charge and discharge to maximize life. Communicates with application to avoid shutdowns.

6.35 mm ALUMINUM TIER PLATES

Benefit: Propagation resistance, ensures an issue is contained.



CELL COMPATIBILITY

Uses 18650 or 21700 cells. All chemistries available based on the applications needs. Direct relationships with SDI, LG, Lishen and Murata.

WIRE BONDING

Benefit: Each cell connected with individual fuse, removing a failed cell electrically from the pack.

CMA MODULES

Benefit: Smaller unit to have finer resolution on temperatures, currents, resistances, voltage within the pack. Serviceable.

Si Series

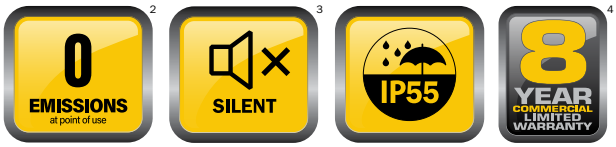
- Easy swapping between applications at the job site to reduce downtime.
- Multiple mounting configurations.
- Integrated Battery Management System (BMS) that ensures safe operations.
- Works across multiple products and brands.
- Can be combined in parallel for additional capacity.

48V 1.5 KWH[1]

Swappable Battery Pack – Si1.5

RELIABLE POWER. EASY INTEGRATION. USER-SWAPPABLE.

Wrapped in a sealed aluminum diecast enclosure, the Vanguard 48V 1.5 kWh[1] Commercial Battery / Si1.5 - Swappable Battery Packs are built to withstand vibration, dust, and dirt, and to be pressure-washed once the job is done. Featuring an integrated battery management system and standard CANbus J1939 communication, these batteries work across multiple brands and applications from 1.5 to 15.0 kWh[1]. 98 Molicel P42A cells inside.



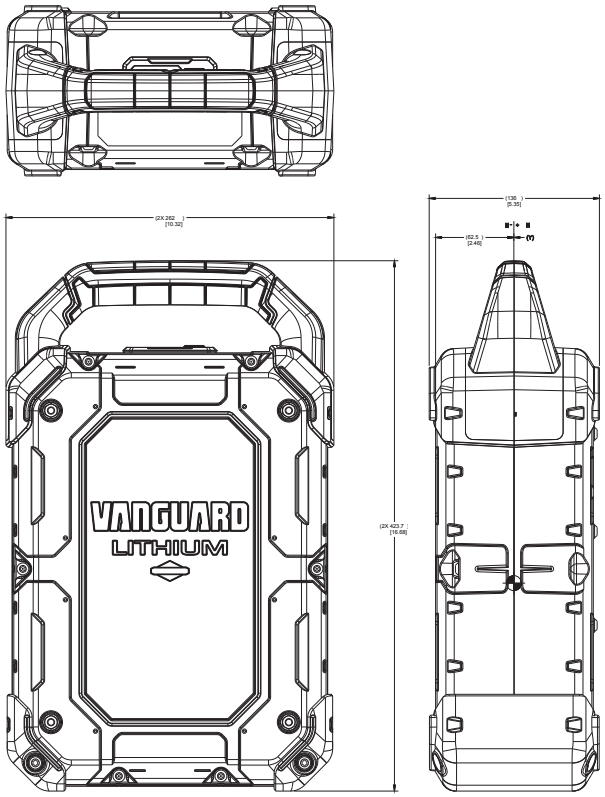
1.5 Nominal Energy (kWh[1])	**51.4** Nominal Voltage (V)
29 Discharge current (A)	**1000** Durability (cycles)

BATTERY FEATURES:

- > Battery Management System (BMS)
- > CANbus J1939 communication
- > Plug-in ready charging system
- > Ingress protection rating IP55
- > Aluminum diecast enclosure
- > Ability to parallel batteries
- > No scheduled maintenance needs
- > New 1425W swappable charger

Battery Type	Swappable battery pack - Si1.5 Lithium-ion integrated Battery Management System
Model Number	80105739
Nominal Voltage (V)	51.4
Top Voltage (V)	58.8
Cut-off Voltage (V)	42.0
Nominal Capacity / Energy (Ah / kWh[1])	28.4 / 1.5
Weight (lbs / kg)	26 / 11,8
Durability (Cycles) at 80% Capacity Retention	Up to 1000
Charge time (hours) Charger	1.25 1425W
Dimensions L x W x H (in / mm)	10.1 x 5.3 x 16.7 / 258 x 136 x 425

DIMENSIONS (mm, [in])



[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.
[2] Zero emissions apply only to the battery pack during operation.
[3] The battery pack is silent, however the application itself may make noise.
[4] See www.vanguardpower.com for warranty details.

Fi Series

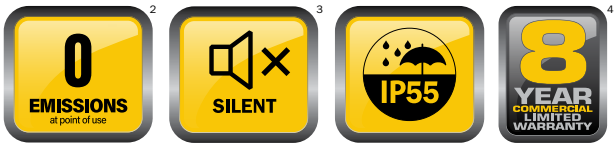
- Designed to integrate seamlessly into any equipment.
- Integrated Battery Management System (BMS) that ensures safe operations.
- Unique Cell Module Assembly (CMA) design.
- Can be combined in parallel for additional capacity.

48V 1.5 KWH[1]

Fixed Battery Pack – Fi1.5

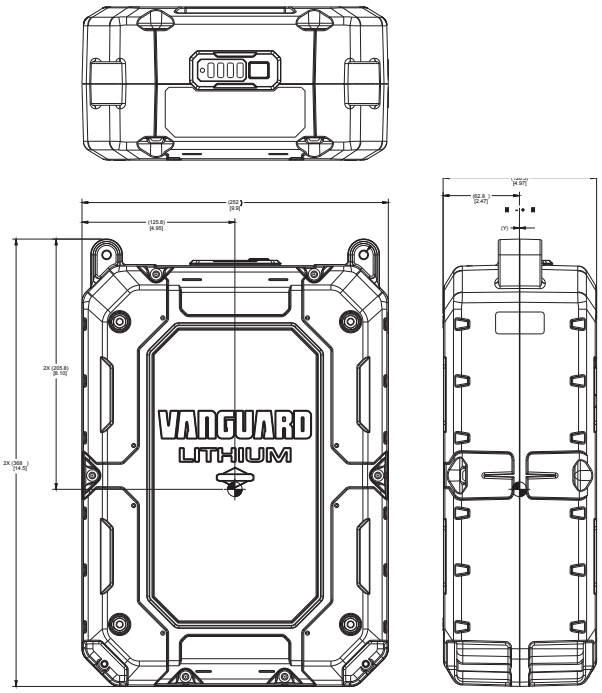
RELIABLE POWER. EASY INTEGRATION.

Wrapped in a sealed aluminum diecast enclosure, the Vanguard 48V 1.5 kWh[1] Commercial Battery / Fi1.5 - Fixed Battery Packs are built to withstand vibration, dust, and dirt, and to be pressure-washed once the job is done. Featuring an integrated battery management system and standard CANbus J1939 communication, these batteries work across multiple brands and applications from 1.5 to 15.0 kWh[1]. 98 Molicel P42A cells inside.



1.5 Nominal Energy (kWh[1])	**51.4** Nominal Voltage (V)
29 Discharge current (A)	**1000** Durability (cycles)

DIMENSIONS (mm, [in])



BATTERY FEATURES:

- Battery Management System (BMS)
- CANbus J1939 communication
- Plug-in ready charging system
- Ingress protection rating IP55
- Aluminum diecast enclosure
- Ability to parallel batteries
- No scheduled maintenance needs
- New 1425W swappable charger

Battery Type	Swappable battery pack - Si1.5 Lithium-ion integrated Battery Management System
Model Number	80113908
Nominal Voltage (V)	51.4
Top Voltage (V)	58.8
Cut-off Voltage (V)	42.0
Nominal Capacity / Energy (Ah / kWh[1])	28.4 / 1.5
Weight (lbs / kg)	25.6 / 11,6
Durability (Cycles) at 80% Capacity Retention	Up to 1000
Charge time (hours) **Charger**	1.25 1425W
Dimensions L x W x H (in / mm)	10.0 x 5.1 x 14.6 / 256 x 131 x 371

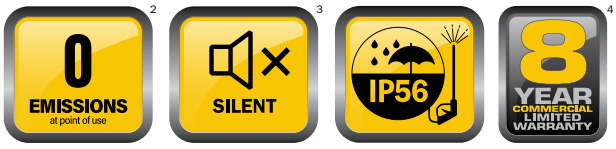
[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.
[2] Zero emissions apply only to the battery pack during operation.
[3] The battery pack is silent, however the application itself may make noise.
[4] See www.vanguardpower.com for warranty details.

24V 3.5 KWH[1]

Fixed Battery Pack – Fi3.5

RELIABLE POWER. EASY INTEGRATION.

Wrapped in a sealed, compact aluminum diecast enclosure, the Vanguard 24V 3.5kWh[1] Commercial Battery / Fi3.5 - Fixed Battery Packs are built to withstand vibration, dust, and dirt, and to be pressure-washed once the job is done. Featuring an integrated battery management system and standard CANbus J1939 communication, these batteries provide reliable power and lower total cost of ownership for a broad range of electrified applications from 3.5 to 35.0 kWh[1]. 196 LG M50L cells inside.



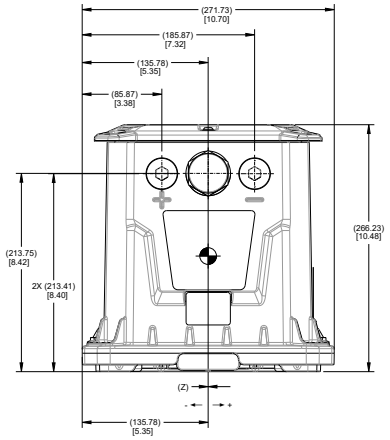
3.5 Nominal Energy (kWh[1])	**25.8** Nominal Voltage (V)
134 Discharge current (A)	**2000** Durability (cycles)

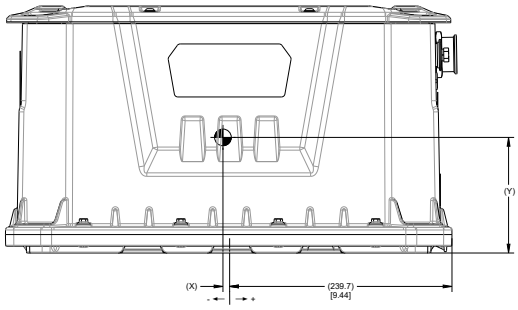
BATTERY FEATURES:

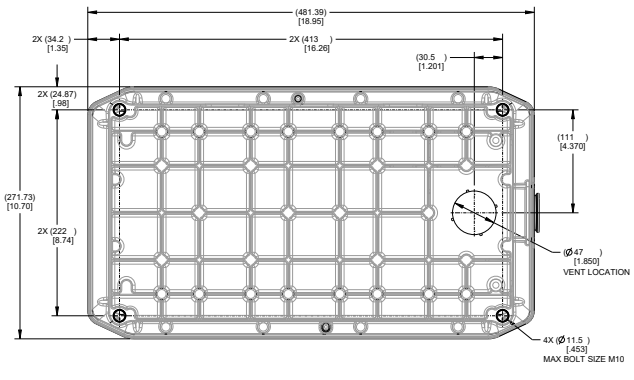
- Battery Management System (BMS)
- CANbus J1939 communication
- Plug-in ready charging system
- Ingress protection rating IP56 and pressure washer
- Aluminum diecast enclosure
- Up to 10 batteries parallel capability
- No scheduled maintenance needs

Battery Type	Fixed battery pack - Fi3.5 Lithium-ion integrated Battery Management System		
Model Number	80127410		
Nominal Voltage (V)	25.8		
Top Voltage (V)	29.4		
Cut-off Voltage (V)	35.0		
Nominal Capacity / Energy (Ah / kWh[1])	135.9 / 3.5		
Weight (lbs / kg)	58 / 26,3		
Durability (Cycles) at 80% Capacity Retention	Up to 2000		
Charge time (hours)	4	3	2
Charger	1050W	1425W	3000W
Dimensions L x W x H (in / mm)	18.9 x 10.7 x 10.4 / 482 x 272 x 266		

DIMENSIONS (mm, [in])







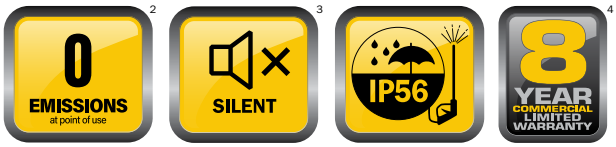
[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.
[2] Zero emissions apply only to the battery pack during operation.
[3] The battery pack is silent, however the application itself may make noise.
[4] See www.vanguardpower.com for warranty details.

48V 3.5 KWH[1]

Fixed Battery Pack – Fi3.5

RELIABLE POWER. EASY INTEGRATION.

Wrapped in a sealed, compact aluminum diecast enclosure, the Vanguard 48V 3.5kWh[1] Commercial Battery / Fi3.5 - Fixed Battery Packs are built to withstand vibration, dust, and dirt, and to be pressure-washed once the job is done. Featuring an integrated battery management system and standard CANbus J1939 communication, these batteries provide reliable power and lower total cost of ownership for a broad range of electrified applications from 3.5 to 35.0 kWh[1]. 196 LG M50L cells inside.



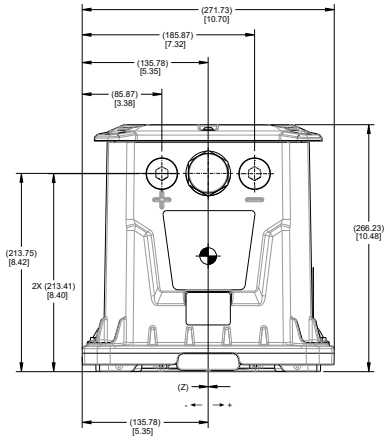
3.5 Nominal Energy (kWh[1])	**51.6** Nominal Voltage (V)
67 Discharge current (A)	**2000** Durability (cycles)

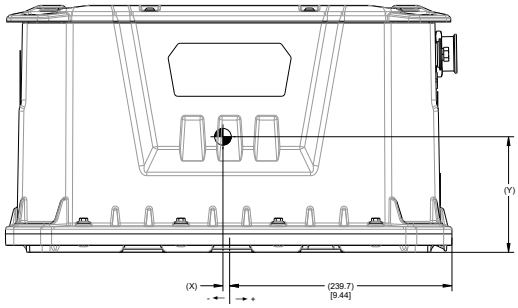
BATTERY FEATURES:

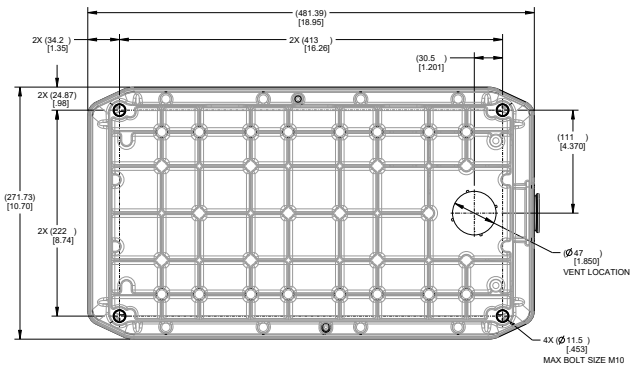
- > Battery Management System (BMS)
- > CANbus J1939 communication
- > Plug-in ready charging system
- > Ingress protection rating IP56 and pressure washer
- > Aluminum diecast enclosure
- > Up to 10 batteries parallel capability
- > No scheduled maintenance needs

Battery Type	Fixed battery pack - Fi3.5 Lithium-ion integrated Battery Management System		
Model Number	80110583		
Nominal Voltage (V)	51.6		
Top Voltage (V)	58.8		
Cut-off Voltage (V)	35.0		
Nominal Capacity / Energy (Ah / kWh[1])	67.5 / 3.5		
Weight (lbs / kg)	58 / 26,3		
Durability (Cycles) at 80% Capacity Retention	Up to 2000		
Charge time (hours) **Charger**	4 1050W	3 1425W	2 3000W
Dimensions L x W x H (in /mm)	18.9 x 10.7 x 10.4 / 482 x 272 x 266		

DIMENSIONS (mm, [in])







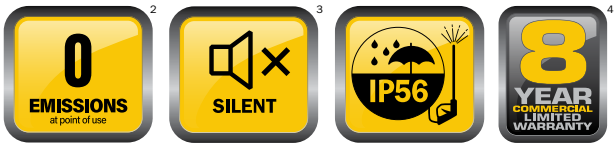
[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.
[2] Zero emissions apply only to the battery pack during operation.
[3] The battery pack is silent, however the application itself may make noise.
[4] See www.vanguardpower.com for warranty details.

48V 5.0 KWH[1]

Fixed Battery Pack – Fi5.0

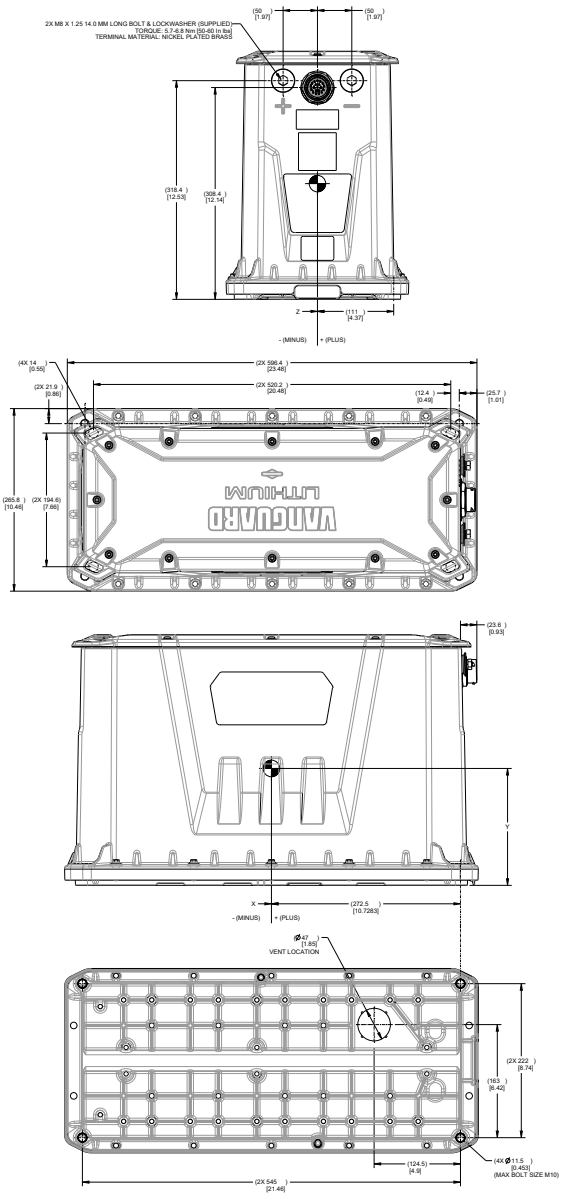
RELIABLE POWER. EASY INTEGRATION.

Wrapped in a sealed, tall aluminum diecast enclosure, the Vanguard 48V 5.0 kWh[1] Commercial Battery / Fi5.0 - Fixed Battery Packs are built to withstand vibration, dust, and dirt, and to be pressure-washed once the job is done. Featuring an integrated battery management system and standard CANbus J1939 communication, these batteries provide reliable power and lower total cost of ownership for a broad range of electrified applications from 5.0 to 50.0 kWh[1]. 280 LG M50L cells inside.



5.1 Nominal Energy (kWh[1])	**51.6** Nominal Voltage (V)
100 Discharge current (A)	**2000** Durability (cycles)

DIMENSIONS (mm, [in])



BATTERY FEATURES:

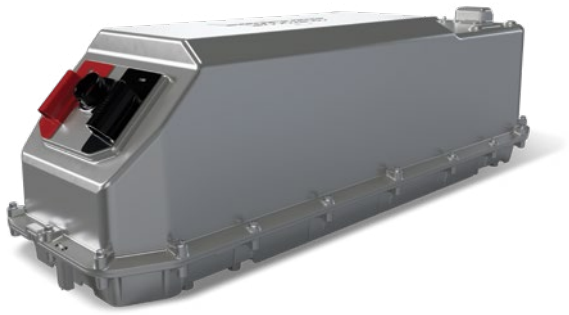
- Battery Management System (BMS)
- CANbus J1939 communication
- Plug-in ready charging system
- Ingress protection rating IP56 and pressure washer
- Aluminum diecast enclosure
- Up to 10 batteries parallel capability
- No scheduled maintenance needs

Battery Type	Fixed battery pack - Fi5.0 Lithium-ion integrated Battery Management System		
Model Number	80112254		
Nominal Voltage (V)	51.6		
Top Voltage (V)	58.8		
Cut-off Voltage (V)	35.0		
Nominal Capacity / Energy (Ah / kWh[1])	98.7 / 5.1		
Weight (lbs / kg)	93.9 / 39		
Durability (Cycles) at 80% Capacity Retention	Up to 2000		
Charge time (hours)	5.5	4	2.5
Charger	1050W	1425W	3000W
Dimensions L x W x H (in / mm)	23.5 x 10.4 x 14.2 / 597 x 266 x 362		

[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.
[2] Zero emissions apply only to the battery pack during operation.
[3] The battery pack is silent, however the application itself may make noise.
[4] See www.vanguardpower.com for warranty details.

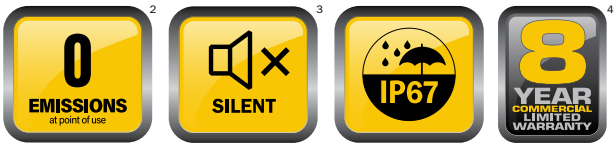
48V 7.0 KWH[1]

Fixed Battery Pack – Fi7.0



RELIABLE POWER. EASY INTEGRATION.

Wrapped in a sealed, long aluminum diecast enclosure, the Vanguard 48V 7.0 kWh[1] Commercial Battery / Fi7.0 - Fixed Battery Packs are built to withstand vibration, dust, and dirt, and to be pressure-washed once the job is done. Featuring an integrated battery management system and standard CANbus J1939 communication, these batteries provide reliable power and lower total cost of ownership for a broad range of electrified applications from 7.0 to 70.0 kWh[1]. 392 LG M50L cells inside.



[2] [3] [4]

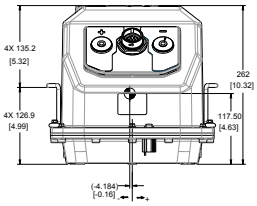
7.0 Nominal Energy (kWh[1])	**51.6** Nominal Voltage (V)
134 Discharge current (A)	**2000** Durability (cycles)

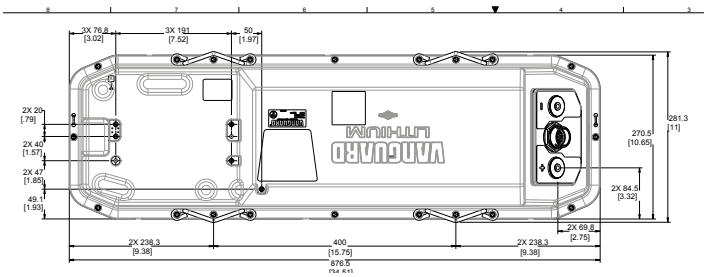
BATTERY FEATURES:

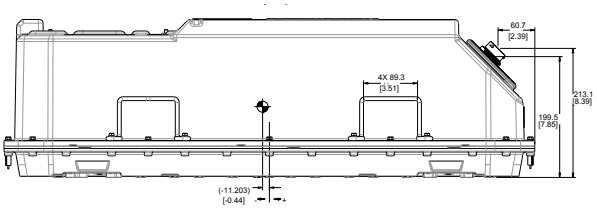
- Battery Management System (BMS)
- CANbus J1939 communication
- Plug-in ready charging system
- Ingress protection rating IP67 and pressure washer
- Aluminum diecast enclosure
- Up to 10 batteries parallel capability
- No scheduled maintenance needs

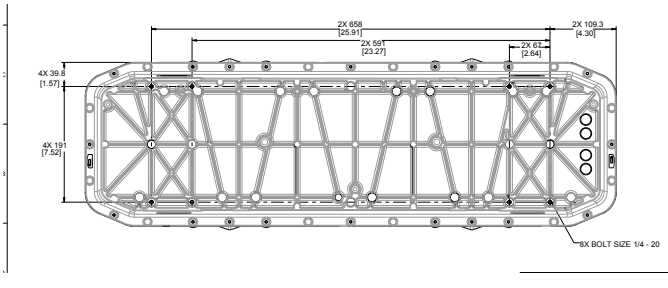
Battery Type	Fixed battery pack - Fi7.0 Lithium-ion integrated Battery Management System		
Model Number	80104774		
Nominal Voltage (V)	51.6		
Top Voltage (V)	58.8		
Cut-off Voltage (V)	35.0		
Nominal Capacity / Energy (Ah / kWh[1])	135.9 / 7.0		
Weight (lbs / kg)	116 / 47,6		
Durability (Cycles) at 80% Capacity Retention	Up to 2000		
Charge time (hours) Charger	8 1050W	6 1425W	3 3000W
Dimensions L x W x H (in / mm)	34.4 x 10.4 x 11.1 / 877 x 281 x 262		

DIMENSIONS (mm, [in])









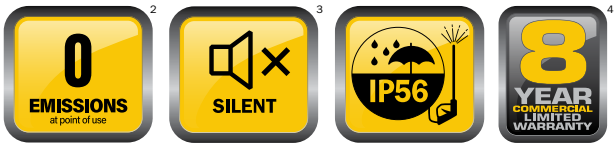
[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.
[2] Zero emissions apply only to the battery pack during operation.
[3] The battery pack is silent, however the application itself may make noise.
[4] See www.vanguardpower.com for warranty details.

48V 7.0 KWH[1]

Fixed Battery Pack – Fi7.0

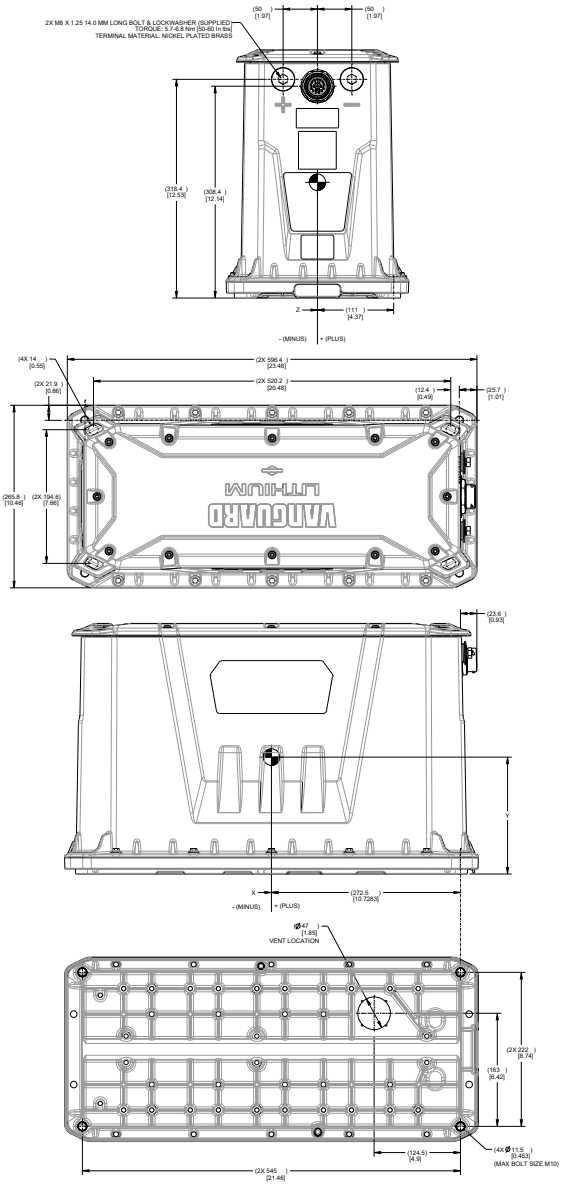
RELIABLE POWER. EASY INTEGRATION.

Wrapped in a sealed, tall aluminum diecast enclosure, the Vanguard 48V 7.0 kWh[1] Commercial Battery / Fi7.0 - Fixed Battery Packs are built to withstand vibration, dust, and dirt, and to be pressure-washed once the job is done. Featuring an integrated battery management system and standard CANbus J1939 communication, these batteries provide reliable power and lower total cost of ownership for a broad range of electrified applications from 7.0 to 70.0 kWh[1]. 392 LG M50L cells inside.



7.0 Nominal Energy (kWh[1])	**51.6** Nominal Voltage (V)
134 Discharge current (A)	**2000** Durability (cycles)

DIMENSIONS (mm, [in])



BATTERY FEATURES:

- Battery Management System (BMS)
- CANbus J1939 communication
- Plug-in ready charging system
- Ingress protection rating IP56 and pressure washer
- Aluminum diecast enclosure
- Up to 10 batteries parallel capability
- No scheduled maintenance needs

Battery Type	Fixed battery pack - Fi7.0 Lithium-ion integrated Battery Management System		
Model Number	80112214		
Nominal Voltage (V)	51.6		
Top Voltage (V)	58.8		
Cut-off Voltage (V)	35.0		
Nominal Capacity / Energy (Ah / kWh[1])	135.9 / 7.0		
Weight (lbs / kg)	110 / 46,3		
Durability (Cycles) at 80% Capacity Retention	Up to 2000		
Charge time (hours) **Charger**	8 1050W	6 1425W	3 3000W
Dimensions L x W x H (in / mm)	23.5 x 10.4 x 14.2 / 597 x 266 x 362		

[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.
[2] Zero emissions apply only to the battery pack during operation.
[3] The battery pack is silent, however the application itself may make noise.
[4] See www.vanguardpower.com for warranty details.

Lithium-Ion Battery Chargers

- Vanguard offers a variety of chargers that pair with Vanguard Battery Packs.
- Plug into standard wall outlets.
- Can be combined in parallel for reduced charging times.

1425W PORTABLE CHARGER

Si 1425W PORTABLE SINGLE-BAY-MOUNTED CHARGER

It can be plugged into a standard wall outlet. The charger seamlessly delivers an electrical current from the 230 V outlet to the Vanguard battery.

100 – 240 V (AC)
Voltage Range, rated

85 – 265 V (AC)
Voltage Range, operating

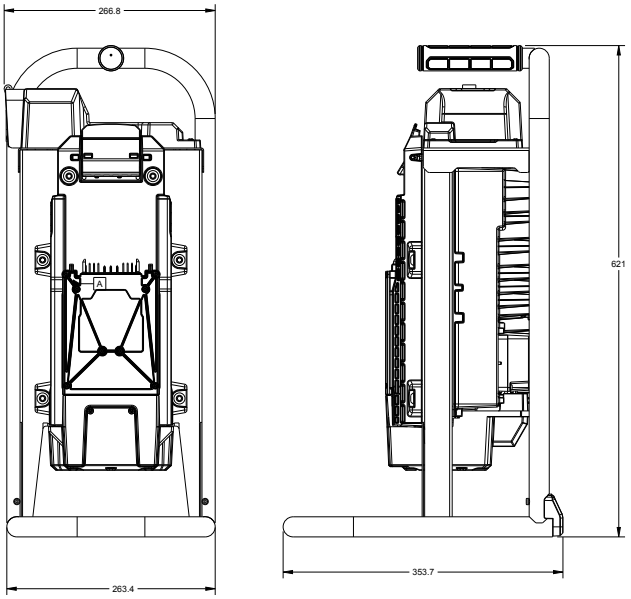
SINGLE-PHASE

CHARGER FEATURES:

- Works seamlessly with battery pack
- Bluetooth capabilities for monitoring AC Input and DC Output specifications
- Can be connected in parallel (2) to reduce charging time
- Enclosure rating IP44 / NEMA 4

Model Number	80126934
Power (DC Output, W)	1425
Voltage, nominal (DC output, V)	48
Voltage, maximum (DC Output, V)	58.8
Current, maximum (DC Output, A)	30
Current, maximum (AC Input, A)	<15
Protection (DC Output)	Current limit, short circuit, reverse polarity, under voltage, over voltage, wrong battery voltage
Enclosure Rating	IP66, NEMA 4
Operating Temperature Range	-13 to 140°F -25 to 60°C
Storage Temperature Range	-40 to 185°F -40 to 85°C
Dimensions for the charger frame and dock (in / mm)	24.44 x 13.9 x 10.4 / 621 x 353,7 x 263,4
Weight (lbs / kg)	28 / 12,7

DIMENSIONS (mm, [in])



[1] See www.vanguardpower.com for warranty details.

1050W CHARGER
& VANGUARD LITHIUM APP

1050 W SINGLE-PHASE CHARGING SYSTEM WITH BLUETOOTH® MONITORING

It can be plugged into a standard wall outlet. The charger seamlessly delivers an electrical current from the 230 V outlet to the Vanguard battery. It can be connected in parallel (2) to reduce charging time.

100 – 240 V (AC)
Voltage Range, rated

85 – 265 V (AC)
Voltage Range, operating

SINGLE-PHASE

CHARGER FEATURES:

- Works seamlessly with battery pack
- Bluetooth capabilities for monitoring AC Input and DC Output specifications
- Can be connected in parallel (2) to reduce charging time
- Enclosure rating IP66 / NEMA 4
- The most powerful fan-less on/off-board charger that works on a standard wall outlet
- Dimensions (L x W x H): 13.2 x 7.1 x 4.4 in
  336 x 182 x 113 mm

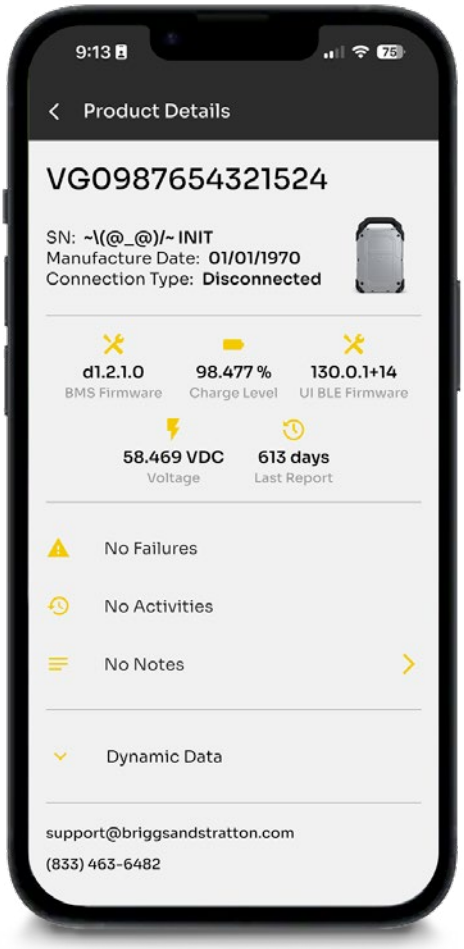
VANGUARD IOT APPLICATION:

- The Vanguard IoT application interfaces wirelessly with Vanguard battery chargers over Bluetooth Smart
- Display diagnostic information related to battery charges
- Allows users to configure battery chargers
- Cloud connectivity

IP66

4 YEAR COMMERCIAL LIMITED WARRANTY[1]

VANGUARD IoT APPLICATION



Available on the App Store | GET IT ON Google Play

[1] See www.vanguardpower.com for warranty details.

1425W CHARGER
& VANGUARD LITHIUM APP

1425W SINGLE-PHASE CHARGING SYSTEM WITH BLUETOOTH® MONITORING

It can be plugged into a standard wall outlet. The charger seamlessly delivers an electrical current from the 230 V outlet to the Vanguard battery.

100 – 240 V (AC)
Voltage Range, rated

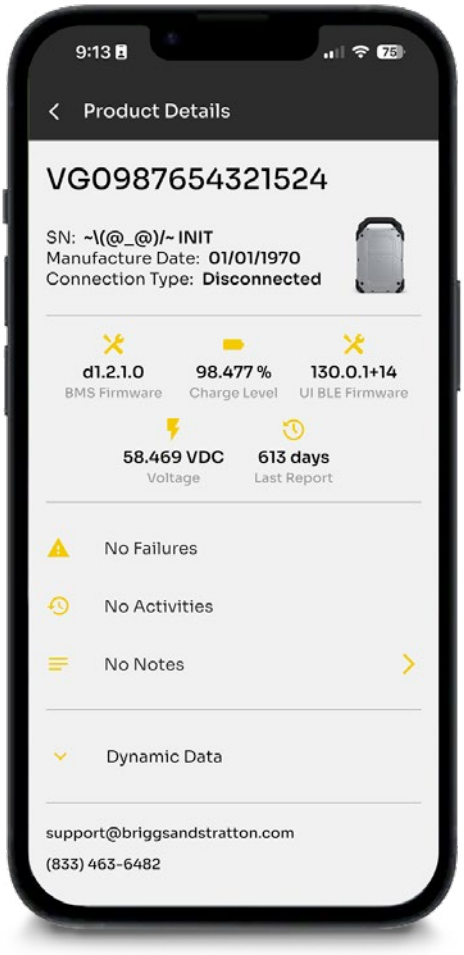
85 – 265 V (AC)
Voltage Range, operating

SINGLE-PHASE

IP66

4 YEAR COMMERCIAL LIMITED WARRANTY[1]

VANGUARD IoT APPLICATION



Available on the App Store GET IT ON Google Play

CHARGER FEATURES:

- Works seamlessly with battery pack
- Bluetooth capabilities for monitoring AC Input and DC Output specifications
- Can be connected in parallel (2) to reduce charging time
- Enclosure rating IP66 / NEMA 4
- The most powerful fan-less on/off-board charger that works on a standard wall outlet

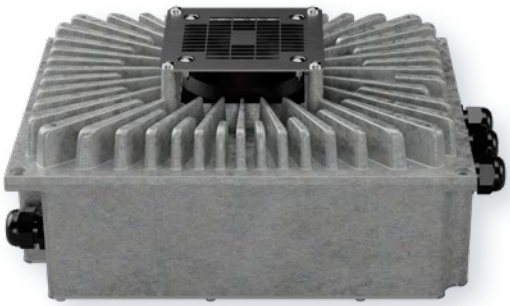
Model Number	80126739
Power (DC Output, W)	1425
Voltage, nominal (DC output, V)	48
Voltage, maximum (DC Output, V)	58.8
Current, maximum (DC Output, A)	30
Current, maximum (AC Input, A)	<15
Protection (DC Output)	Current limit, short circuit, reverse polarity, under voltage, over voltage, wrong battery voltage
Operating Temperature Range	-13 to 140°F / -25 to 60°C
Storage Temperature Range	-40 to 185°F / -40 to 85°C
Dimensions (in / mm)	13.4 x 8.1 x 4.5 / 341 x 208 x 115
Weight (lbs / kg)	1.45 / 6,1

[1] See www.vanguardpower.com for warranty details.

3000W CHARGER

3000W SINGLE-PHASE CHARGING SYSTEM

It can be plugged into a standard wall outlet. The charger seamlessly delivers an electrical current from the 230 V outlet to the Vanguard battery. It can be connected in parallel (2) to reduce charging time.



100 – 240 V (AC)

Voltage Range, rated

90 – 265 V (AC)

Voltage Range, operating

SINGLE-PHASE

CHARGER FEATURES:

- Works seamlessly with battery pack
- Rugged design made to be mounted on-board or off-board
- Convenient style charging
- Ability to plug the charger into a standard 120-volt wall outlet or 240-volt outlet to deliver electric current to the battery
- Enclosure rating IP55

Model Number	80114089
Power (DC Output, W)	3000
Voltage, nominal (DC output, V)	48
Voltage, maximum (DC Output, V)	58.8
Current, maximum (DC Output, A)	60
Current, maximum (AC Input, A)	16 (at 220 VAC)
Protection (DC Output)	Current limit, short circuit, reverse polarity, under voltage, over voltage, wrong battery voltage
Operating Temperature Range	-4 to 122°F / -20 to 50°C
Storage Temperature Range	-40 to 176°F / -40 to 80°C
Dimensions (in / mm)	12.7 x 8.6 x 5.5 / 324 x 204 x 142
Weight (kg)	17.6 / 8

[1] See www.vanguardpower.com for warranty details.

MVG Motors

Vanguard Battery Systems will offer high-power motors that will seamlessly integrate and complete a full battery system for OEM application needs.

Brushless Permanent Magnet

> Ensures high efficiency.

Automotive-Grade Durability

> Built to automotive standards for unmatched reliability. Delivers outstanding resilience and reliability.

Maintenance-Free Operation

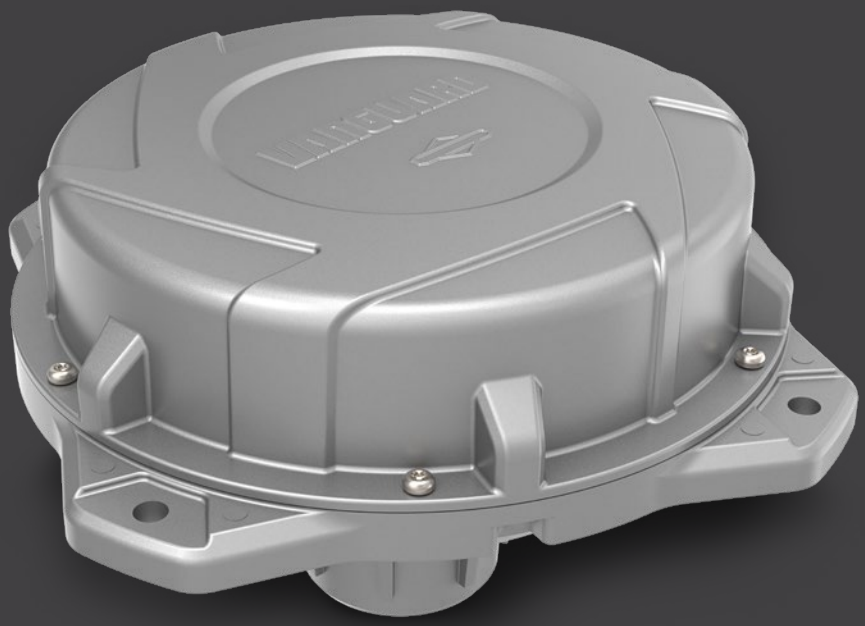
> Designed to operate without the need for regular maintenance.

Easy Integration Features

> Reduces development costs and enhances flexibility for legacy applications. Standard mounting to support ICE replacement.

Serviceable Products

> Helps avoid costly replacements.



MVG1500 MOTOR

HIGH-POWER MOTORS THAT WILL SEAMLESSLY INTEGRATE INTO A FULL BATTERY SYSTEM.

The Vanguard MVG1500 is built to an automotive grade that offers unmatched durability. With high speed and high torque performance for vertical shaft applications, this motor is a single component of what can be a fully integrated system. The MVG1500 has an internal motor controller which provides OEMs with lower costs and easier battery-to-equipment integration. No maintenance is required.

IP65

2 YEAR COMMERCIAL LIMITED WARRANTY[1]

1500 W Output Power (Continuous)	**3500 W** Output Power (Peak)
5 Nominal Torque (Nm)	**3600** Nominal Speed (RPM)

Motor Type	MVG1500
Model Number	TBC
Motor Type	Brushless PM
Nominal Input Voltage	48 VDC
Maximum Input Voltage	72 VDC
Output Power (Continuous)	1500 W
Output Power (Peak)	3500 W
Nominal Torque	5 Nm
Maximum Torque	20 Nm
Nominal Speed	3600 RPM
Maximum Speed	4000 RPM (at 48V)
Efficiency (Peak)	0.92
Operating Temperature Range	Up to 40°C
Enclosure Rating	IP65
D x L Body/PTO (in / mm)	8.8 x 6.1 x 6.3 / 225 x 155 x 160
Features	Internal motor controller, simplified system integration, brushless PM, automotive grade design, high torque outer rotor design

[1] See www.vanguardpower.com for warranty details.

MC Controllers

Vanguard Battery Systems will offer integrated motor controllers to seamlessly engineer safe and efficient equipment for OEM application needs.

J1939 Communication
> Simplified integration with Vanguard batteries.

Automotive Grade Design
> Outstanding resilience and reliability.

Auto-Tuning
> Less work to optimize your system.

Fault Protection
> Keep the equipment working as well as possible, as long as possible.

Multiple Control Modes
> Control speed, torque, or a combination.

MOTOR CONTROLLERS

MC2000, MC4000 and MC8000

INTEGRATED MOTOR CONTROLLERS TO SEAMLESSLY ENGINEER SAFE AND EFFICIENT EQUIPMENT.

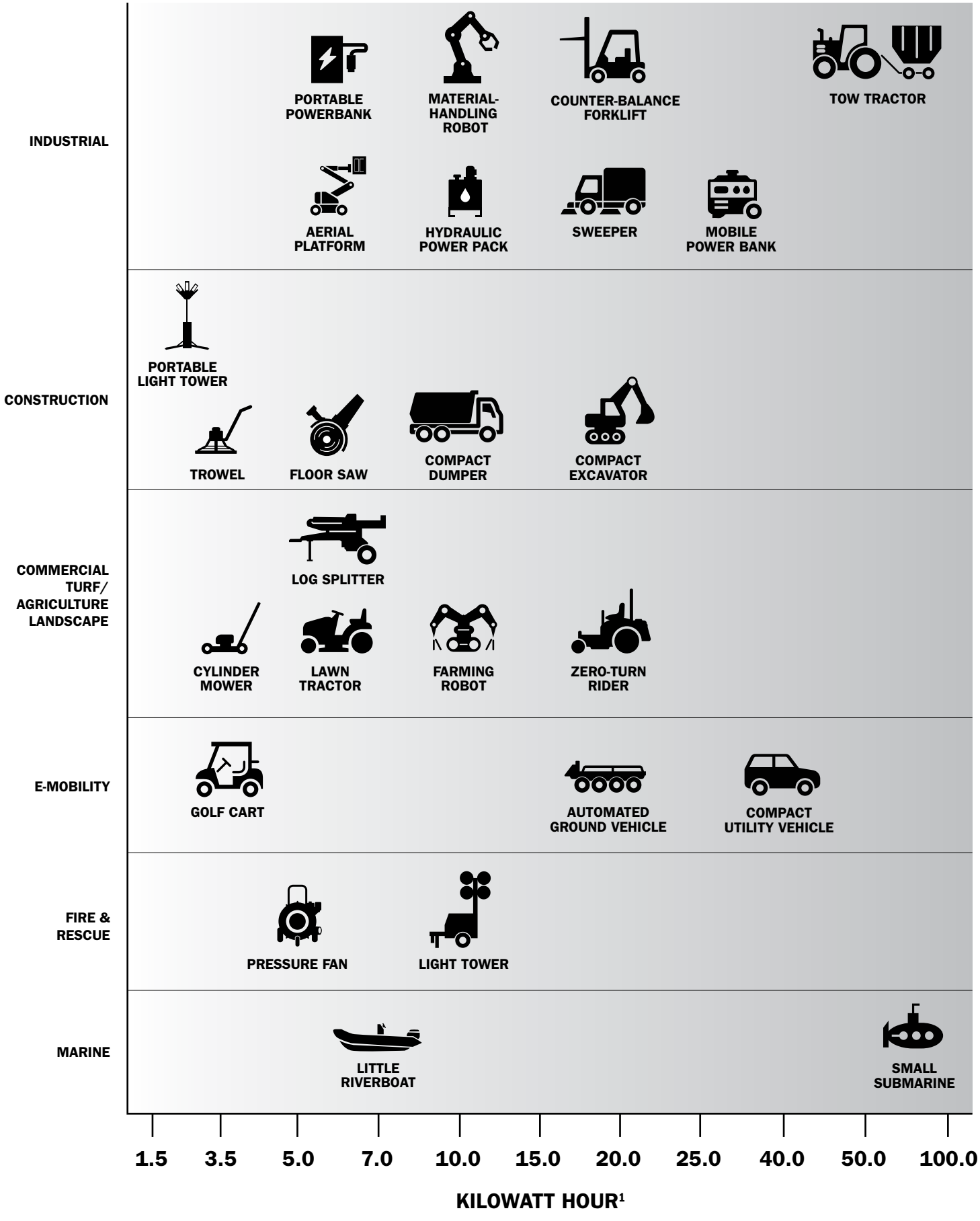
Built to an automotive grade offering maximum durability. This controller comes with a high power density, auto-tuning, and configurable regenerative braking. OEMs can bring fully integrated power equipment to the market with our family of controllers. No maintenance is required.

IPx5

2 YEAR COMMERCIAL LIMITED WARRANTY[1]

Controller Type	MC2000	MC4000	MC8000
Model Number	80094680	80135006	80135007
Nominal Input Voltage	48 VDC	48 VDC	48 VDC
Maximum Input Voltage	72 VDC	72 VDC	72 VDC
Minimum Input Voltage	18 VDC	18 VDC	18 VDC
Phase Current (Peak)	200 A	430 A	840 A
Efficiency (Peak)	99%	99%	99%
Supported Motor Types	Three-phase SPM	Three-phase SPM	Three-phase SPM
Fault Protection	Over/under voltage, over temperature, over current	Over/under voltage, over temperature, over current	Over/under voltage, over temperature, over current
Operating Temperature Range	-4 to 203°F / -20 to 95°C	-4 to 203°F / -20 to 95°C	-4 to 203°F / -20 to 95°C
Storage Temperature Range	-31 to 203°F / -35 to 95°C	-31 to 203°F / -35 to 95°C	-31 to 203°F / -35 to 95°C
Enclosure Rating	IPx5	IPx5	IPx5
L x W x H (in / mm)	4.9 x 5.7 x 2.0 / 125 x 145 x 52	6.8 x 5.7 x 2.0 / 174 x 145 x 52	9.7 x 5.7 x 2.0 / 246 x 145 x 52
Features	Supports Hall effect or sensorless motors; speed, torque, and hybrid control modes; thermal cutback; Bluetooth communication; 100% end-of-line test at power		

WHAT APPLICATIONS CAN YOU POWER?



[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.

COMPARING LEAD-ACID VS LITHIUM-ION BATTERIES.

The world is changing, and batteries are changing the way we use power as it grows into an increasingly in-demand-power source. However, choosing the right battery pack solution for the application of OEMs may feel like unfamiliar territory. There are multiple parameters to consider (including voltage, safety, capacity) that make the process of selecting the best battery a complex task. We're breaking down the main differences between a lead acid battery and a lithium-ion battery for you.

LEAD-ACID

VS

LITHIUM-ION

BATTERY BASICS

- Very heavy, but can act as a counterweight
- Rechargeable
- High surge currents at startup
- Unsophisticated and simple to function
- Heat up when charged or discharged, wasting energy
- Efficiency can drop to as low as 50% during high use
- Higher self-discharge rate
- Entire battery must be replaced if 1 cell fails
- Lower cost, but may not last through entire usage case

> 5x lighter than lead acid battery
> Rechargeable
> No surge current at startup
> "Smart" –battery management system (BMS) offers temperature monitoring, data on power utilization and voltage, the ability to integrate with Internet of Things (IoT) devices, and more
> High energy density
> Up to 93%+ efficiency
> Low self-discharge rate; holds charge longer
> Modular, more serviceable design available
> Battery more likely to last entire life of equipment

SAFETY

- Plates need to be continuously soaked in a liquid mixture of sulfuric acid and water to operate correctly
- Dangerous materials; risk of being exposed to acid when watering
- Acid-resistant PPE required when servicing
- No safety monitoring
- No safety backups

> Maintenance free
> No exposure to dangerous materials
> No PPE required to handle battery
> BMS constantly monitors and measures temperature, charge and discharge currents and voltages of each individual cell bank
> Safeties in place to reduce potential of thermal runaway, including high temperature shut down

SUSTAINABILITY

- Recyclable
- Risk of sulfuric acid and/or lead leakage if damaged or improperly stored
- Shorter lifecycle
- Lower IP rating: battery becomes unusable with water intrusion
- Emissions-free

> Recyclable + cleaner to produce and consume
> Particularly environmentally stable and durable
> Longer lifecycle
> Higher IP rating: better protection against intrusion, dust, accidental contact, water
> Emissions-free

WHAT YOU NEED TO CONSIDER WHEN INTEGRATING ELECTRIFIED POWER.

The electrification of commercial grade machinery is one of the biggest talking points for OEMs today. Design and manufacture in-house or collaborate with an electrification partner? This is fundamentally the most important decision you will need to make at the beginning of your electrification journey.

When it comes to batteries, sourcing cells and components off the shelf to manufacture your own system seems easier and less capital intensive than with traditional engines – providing an alternative path to gain flexibility, increased customization and ultimately save costs. However, producing and integrating electrification effectively into machinery can be full of potential pitfalls…

So, here is our advice to successfully integrate electrified power:

GAUGE MARKET EXPECTATIONS

Before embarking on your electrification project, you should consider the following: charge times, daily usage (hours used), life expectancy, load conditions, peak power draw, cooling requirements, operating temperatures, work environment, weight and price.

UNDERSTAND REAL-LIFE APPLICATION USAGE

Ensure your team fully understands real-life usage conditions – not just internal testing criteria – in order to qualify a product. Make a comprehensive list of all critical parameters, including but not limited to, power peaks, heat (temperature), current draw, cooling requirements, daily hour usage, user life expectations and load response.

OBTAIN THE RIGHT KNOW-HOW

Work with an established and experienced technology partner who can bring vast electrification and application engineering expertise to the table. While this may incur additional upfront costs, they can streamline the electrification process and save you time and money in the long run.

ACCESS TO NEW TECHNOLOGY

Identify a strong partner who has access to the latest technology from Tier 1 and 2 suppliers. Their economies of scale will give you access to industry-leading technology at a more affordable price point.

UNDERSTAND SAFETY REQUIREMENTS

Lithium-Ion, with the proper system management, is safer, longer-lasting and more powerful than lead-acid. But it is extremely important that your team understands all the safety requirements. Technology partners have this know-how and can ensure you address these critical safety measures in the very early stages of development.

BATTERY SIZING MADE SIMPLE.

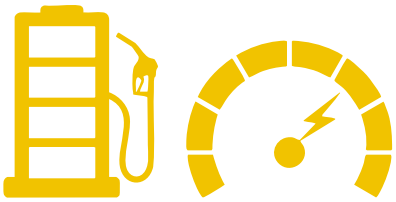
Designing the right battery system is about balance — between power, energy, runtime and cost. Follow these four essential steps to get your sizing right.

STEP 1 POWER VS ENERGY.

Before choosing a battery, understand the difference between **power (kW)** and **energy (kWh).**

- **Power** is how quickly work is done — the strength or speed of performance.
- **Energy** is how long your machine can operate before it needs recharging.

Getting this balance right ensures your equipment delivers both performance and endurance. Don't size the battery only for the highest possible load; design around the real power needs of your system.



Term:	**Energy**	**Power**
Unit:	kWh	kW
Analogy:	Fuel tank size	Engine horsepower
Message:	How long the system can run	How strong or fast the system can perform

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STEP 2 UNDERSTAND THE DUTY CYCLE.

Your duty cycle shows how the machine actually uses power throughout the day. You might have:

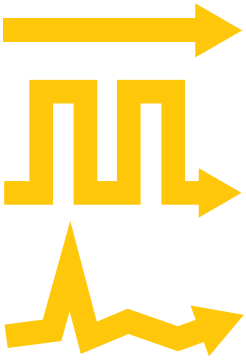
- **Continuous loads** – steady power draw (for example, pumps or pressure washers).
- **Intermittent loads** – on-and-off use (for example, handheld tools).
- **Peak loads** – short bursts of high power (for example, lifting or digging equipment).

Measuring your duty cycle — not just assuming total shift time — gives a realistic picture of power demand. Collecting this real-world data early makes battery sizing far more accurate.

Continuous Loads

Intermittent Loads

Peak Loads



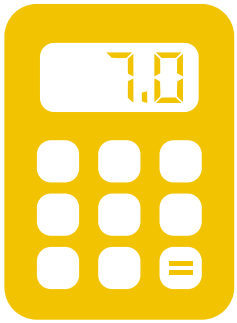
STEP 3

INCORPORATE BUFFERS.

No two working days are the same. To keep runtime consistent, always build in some margin:

- **Depth of Discharge (DoD):** Use about 90–95 % of rated capacity, not 100 %.
- **Runtime Buffer:** Add 10–20 % extra capacity for unexpected peaks or tough conditions.
- **Long-Term Degradation:** Allow for gradual capacity loss over hundreds of cycles.

These buffers safeguard performance and extend service life.



TO CALCULATE BUFFERS:

Average Power Draw (kW)
x Required Runtime (hrs)
= **Baseline energy needed (kWh)**
+ 5 to 10% DoD Buffer
+ 10 to 20 % Runtime Buffer
+ X% Aging Allowance
= **OPTIMAL BATTERY SIZE**

STEP 4

PROTOTYPE AND TEST.

With your duty cycle and energy needs defined, validate them through **prototype testing.**

Trial the system under real conditions to confirm runtime, temperature control and recharge performance. If results fall short, adjust battery size or control settings before full production.

GET STARTED WITH VANGUARD.

Every application is unique — and so is the ideal battery solution.

Get in touch with us, and we'll connect you with our **Power Application Centre** team or one of our trusted **Technology Partners** to help optimize your electrified system from the ground up.

BATTERY TECHNICAL SPECIFICATIONS

8 YEAR COMMERCIAL LIMITED WARRANTY[2]

	Si1.5	Fi1.5	Fi3.5
SPECIFICATION	48V 1.5kWh[1]	48V 1.5 kWh[1]	24V 3.5 kWh[1]
ENCLOSURE MATERIALS	Aluminum	Aluminum	Aluminum
NOMINAL VOLTAGE	51.4 V	51.4 V	25.8 V
DISCHARGE CUTOFF VOLTAGE	42.0 V	42.0 V	17.5 V
DISCHARGE CURRENT, NOMINAL	29 A	29 A	134 A
DISCHARGE CURRENT, MAX. CONTINUOUS	100 A	100 A	200 A
DISCHARGE CURRENT, 10S SURGE	‡3S surge of 180A	‡3S surge of 180A	400 A
NOMINAL CAPACITY (PER IEC61960)	28.4 Ah	28.4Ah	135.9 Ah
NOMINAL ENERGY (PER IEC61960)	1.5 kWh	1.5 kWh	3.5 kWh
DISCHARGE TEMPERATURE RANGE	-40 to + 158°F -40 to + 70°C	-40 to + 140°F -40 to +60°C	-4 to + 140°F -20 to +60°C
PARALLEL CAPABLE	Yes	Yes	Yes
MARKETED DURABILITY	Up to 1000 cycles to 80% initial capacity	Up to 1000 cycles to 80% initial capacity	Up to 2000 cycles to 80% initial capacity

CHARGING

CHARGE VOLTAGE (PER IEC61960)	58.8 V	58.8 V	29.4 V
CHARGE TEMPERATURE RANGE	32 to +113°F 0 to +45°C	32 to +113°F 0 to +45°C	32 to +113°F 0 to +45°C
CHARGE TIME WITH 1050W VANGUARD™ CHARGER	N/A	N/A	6 Hours
CHARGE TIME WITH 1425W VANGUARD™ CHARGER§	1.25 Hours	1.25 Hours	5 Hours
CHARGE TIME WITH 3000W VANGUARD™ CHARGER§	N/A	N/A	4 Hours

DIMENSIONS/WEIGHT

PACK FRAME DIMENSIONS L×W×H in / mm	10.2 x 5.4 x 16.7 / 258 x 136 x 425	10.1 x 5.1 x 14.6 / 256 x 131 x 371	19.9 x 11.5 x 10.5 / 482 x 272 x 266
PACK WEIGHT LBS / KG	26 / 11,8	25.6 / 11,6	58 / 26,3

[1] Total energy measured using a 0.2C discharge per IEC 61960-3:2017.
[2] See www.vanguardpower.com for warranty details

BATTERY TECHNICAL SPECIFICATIONS




Fi3.5	**Fi5.0**	**Fi7.0**	**Fi7.0**
48V 3.5 kWh[1]	48V 5.0 kWh[1]	48V 7.0 kWh[1]	48V 7.0 kWh[1]
Aluminum	Aluminum	Aluminum	Aluminum
51.6 V	51.6 V	51.6 V	51.6 V
35.0 V	35.0 V	35.0 V	35.0 V
67 A	100 A	134 A	134 A
134 A	200 A	200 A	200 A
200 A	300 A	400 A	400 A
67.5 Ah	98.7 Ah	135.9 Ah	135.9 Ah
3.5 kWh	5.1 kWh	7.0 kWh	7.0 kWh
-4 to + 140°F -20 to +60°C	-4 to + 140°F -20 to +60°C	-4 to + 140°F -20 to +60°C	-4 to + 140°F -20 to +60°C
Yes	Yes	Yes	Yes
Up to 2000 cycles to 80% initial capacity	Up to 2000 cycles to 80% initial capacity	Up to 2000 cycles to 80% initial capacity	Up to 2000 cycles to 80% initial capacity

58.8 V	58.8 V	58.8 V	58.8 V
32 to +113°F 0 to +45°C	32 to +113°F 0 to +45°C	32 to +113°F 0 to +45°C	32 to +113°F 0 to +45°C
4 Hours	5.5 Hours	8 Hours	8 Hours
3 Hours	4 Hours	6 Hours	6 Hours
2 Hours	2.5 Hours	3 Hours	3 Hours

19.9 x 11.5 x 10.5 / 482 x 272 x 266	23.3 × 10.5 × 14.4 / 597 × 266 × 362	34.5 x 11.2 x 10.4 / 877 x 281 x 262	23.3 x 10.5 x 14.4 / 597 x 266 x 362
58 / 26,3	93.9 / 39	116 / 47,6	110 / 46,3

LOOKING FOR SUPPORT?

At Vanguard we are more than a component supplier — we are **a technical integration partner,** with expertise in load profiling, battery chemistry, and power system design.

We help OEMs achieve the same (or better) performance with smaller, optimised batteries to reduce weight, cost, and footprint while maximising uptime and reliability.

Vanguard's Power Application Centres (PACs) and engineering teams partner with OEMs to collect real-world data and design data-driven, efficient electrification systems. In addition our Technology Partner Network provides even wider technical assistance.

Electrify smarter, not harder — with Vanguard.

VANGUARD™

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